

SUNSET VISTA

The Theaker Subdivision

CEQA/Preliminary Drainage Study

for

TM 5257RPL 4

ER01-09-019

Original June 8, 2001
Revised November 23, 2001
Revised April 5, 2002
Revised May 24, 2002
Revised November 12, 2003
Revised October 21, 2004
Revised June 12, 2005
Revised January 3, 2006

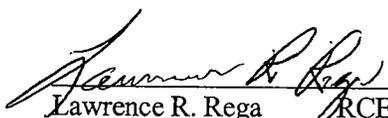
Prepared for:

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Ramona, CA 92065

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Prepared By: CFH
Reviewed By: JB

**PRELIMINARY DRAINAGE STUDY
THOMAS THEAKER SUBDIVISION
(SUNSET VISTA)
TM 5257 RPL4**

I. INTRODUCTION

Purpose of Study

This study has been prepared to determine the need for drainage facilities for the Thomas Theaker Subdivision (Sunset Vista). This project also evaluates the surface water flow over the natural terrain and the proposed development. Finally, this report studies the natural drainage course and the possible impacts of the future residential development of the Thomas Theaker Subdivision (Sunset Vista).

This study analyzes the 100-year storm event due to the existing drainage patterns flowing through the property, and determines the width of a nature channel running through the property.

Study Area

The location of the Thomas Theaker Property is as shown on the vicinity map in this report. The project site is located immediately north of Hanson Lane and east of Ashley Road within the town center in the community of Ramona. The project site totals 9.3 acres and is proposed as a single subdivision that will create eight legal parcels (ranging from 1.0 to 1.4 acres) that will ultimately support a single family residence on each of the parcels. The following zoning applies to the property:

Regional Category:	Current Urban Development Area (CUDA)
Land Use Designation:	(1) Residential
Planning Area:	Ramona Community Plan
Planning Group:	Ramona Planning Group
Use Regulation:	A70 (1.0-acre minimum lot size)

Special Area Regs.: None
Animal Regulation L

The overall offsite study area is a watershed of 171.3 acres. The area drains from an elevation of 1670 in the northeast and flows to the east property line of the project site toward an elevation of 1476. This shed area is primarily undisturbed rural agricultural land designed with a coefficient for lots larger than ½ acre.

On site the 9.3 acre property is occupied by an abandoned house and covered with native grasses. It primarily drains across rolling flat terrain from the northwest to the southeast to meet a low point midway along the frontage of Hanson Lane. The offsite drainage enters midway along the eastern property line and fans out flat flowing toward Hanson Lane. The subdivision property's elevation ranges from a high point of 1493 in the northeast to a low point of 1473 at the drain pipe inlet at Hanson Lane. Currently, the existing 18" RCP culvert has insufficient capacity and flood waters pond upstream before over topping Hanson Lane and continuing south.

Soil Group

The County/USGS Soil Maps indicated that the majority of this area consists of Type D soils. Therefore, to be conservative, Soil Type D is used in this report for all the calculations.

Hydrology and Hydraulics

Storm water calculations were determined per the Rational Method as described in the County of San Diego Hydrology Manual (dated 2003). The storm cycle used for this project is the 100-year event. The corresponding 6-hour rainfall amount is 3.5 inches.

The HEC-RAS computer program is used to determine the 100-year flood line of inundation for proposed and existing geometry.

II. CONCLUSION

Based upon the calculations in this report, it is apparent that the existing natural channel transecting the subject property has the hydraulic capacity to convey the flow of a 100-year storm event of approximately 228 CFS. In addition, the hydrology calculations show that the proposed development of the Thomas Theaker Subdivision (Sunset Vista) would not increase this existing flow or the existing water surface elevation. The hydrologic calculations show that the pre-development and post-development flows would remain the same, at 228 CFS, and no flood detention is needed.

The proposed profile of Hanson Lane will prevent overtopping of the road during the 100-year storm event and flood waters will pass under the road through a box culvert. An evaluation of the existing 18-inch RCP storm drainpipe crossing under Hanson Lane were done however it was found that the upsizing would not satisfy the requirements to handle the Q_{100} without cresting over Hanson Lane. Based on our hydrologic analysis for the 100 year storm event and profile of Hanson Lane, we have concluded that 2-2'x 10' culverts will serve the projects' drainage requirements.

The proposed grading was designed to improve the hydraulics of flow by gradually contracting the flow through the two box culverts. A study of basin area was done to model the effects of the proposed improvements on the flood plain. A comparison of the existing and proposed flood plan maps show that the only changes to the one percent annual flooded area occur within the project boundary. No adverse affect are predicted both upstream and downstream of the project area by the proposed improvements.

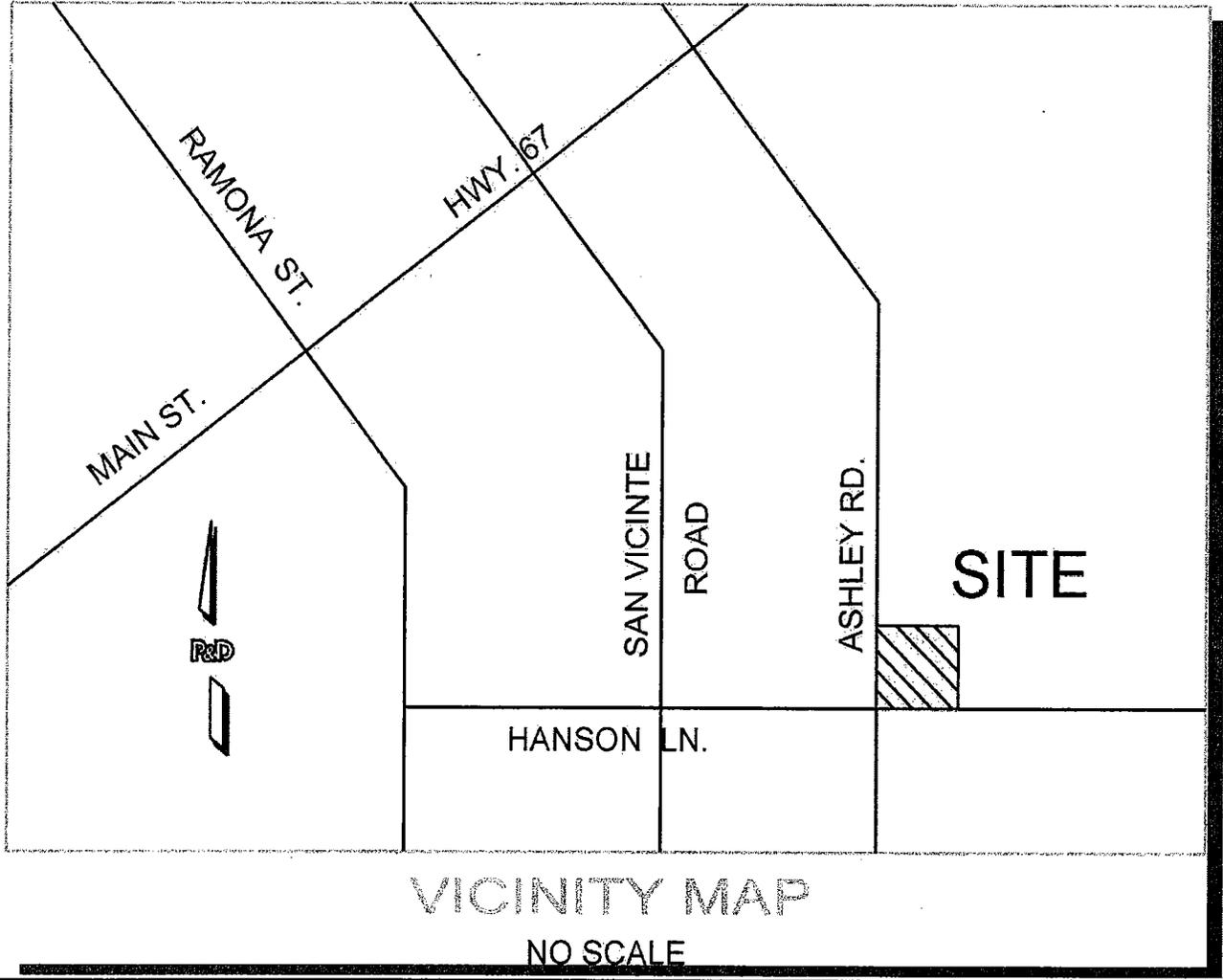
In summary, it has been concluded that the reshaping of the low end of the 100-year floodplain, and proposed improvements to Hanson Lane will eliminate the roadway inundation while maintaining the current runoff status.

HYDROLOGY CALCULATION SUMMARY

	Existing	Proposed
<i>Offsite Drainage Basin</i>		
A (acre)	171.3	171.3
T_C (min)	28	28
Q_{100} (CFS)	215	215
<i>Onsite Drainage Basin</i>		
A (acre)	10.7	10.7
T_C (min)	28	11
Q_{100} (CFS)	16	24
<i>Total*</i>		
<i>A (acre)</i>	<i>182.0</i>	<i>182.0</i>
<i>T_C (min)</i>	<i>28</i>	<i>28</i>
<i>Q_{100} (CFS)</i>	<i>227</i>	<i>227</i>

* Total flow at Node 300 after confluence per Hydrology Calculation (see Appendix "A").

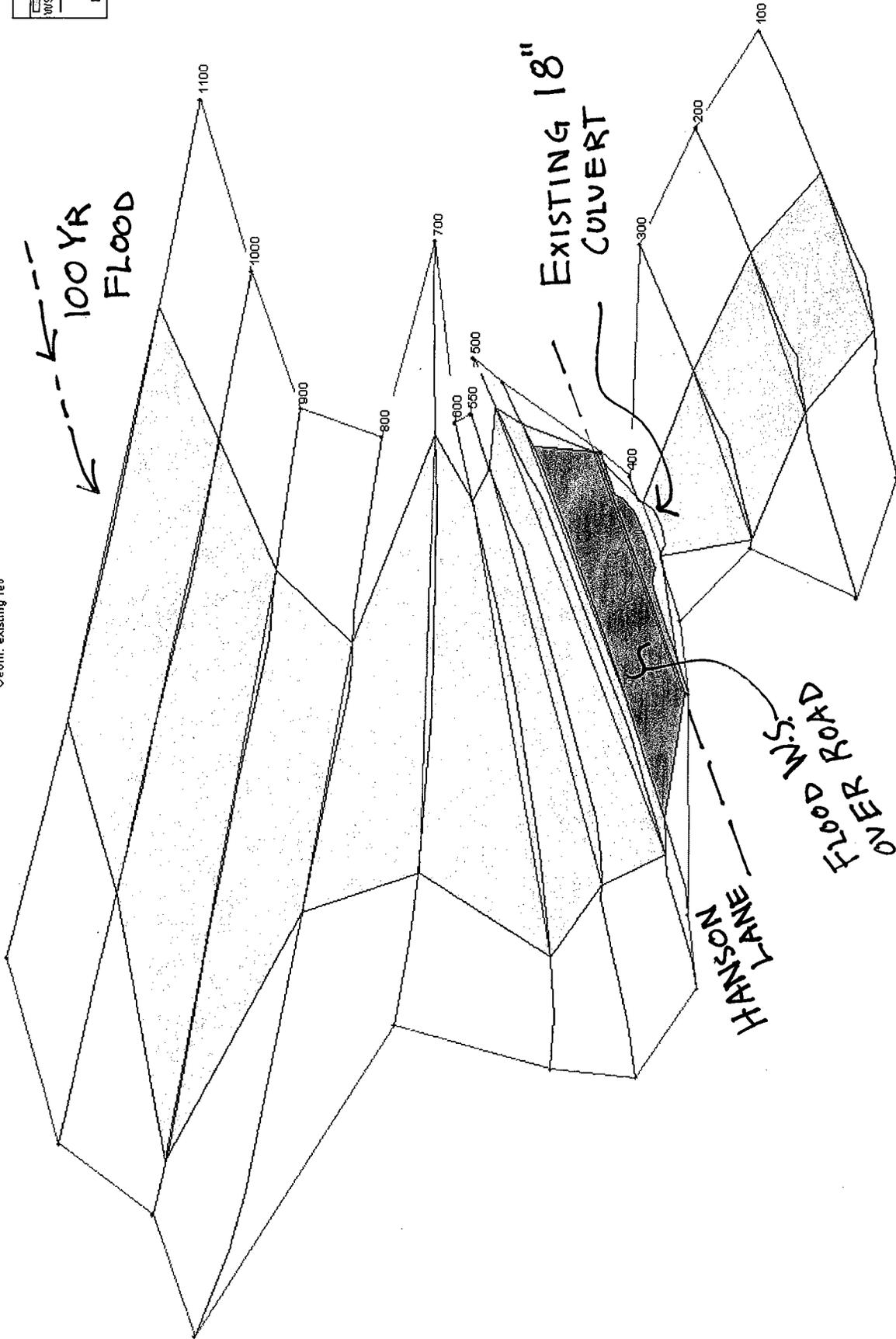
Vicinity Map



EXISTING CONDITIONS

Theaker Property
Geom: existing rev

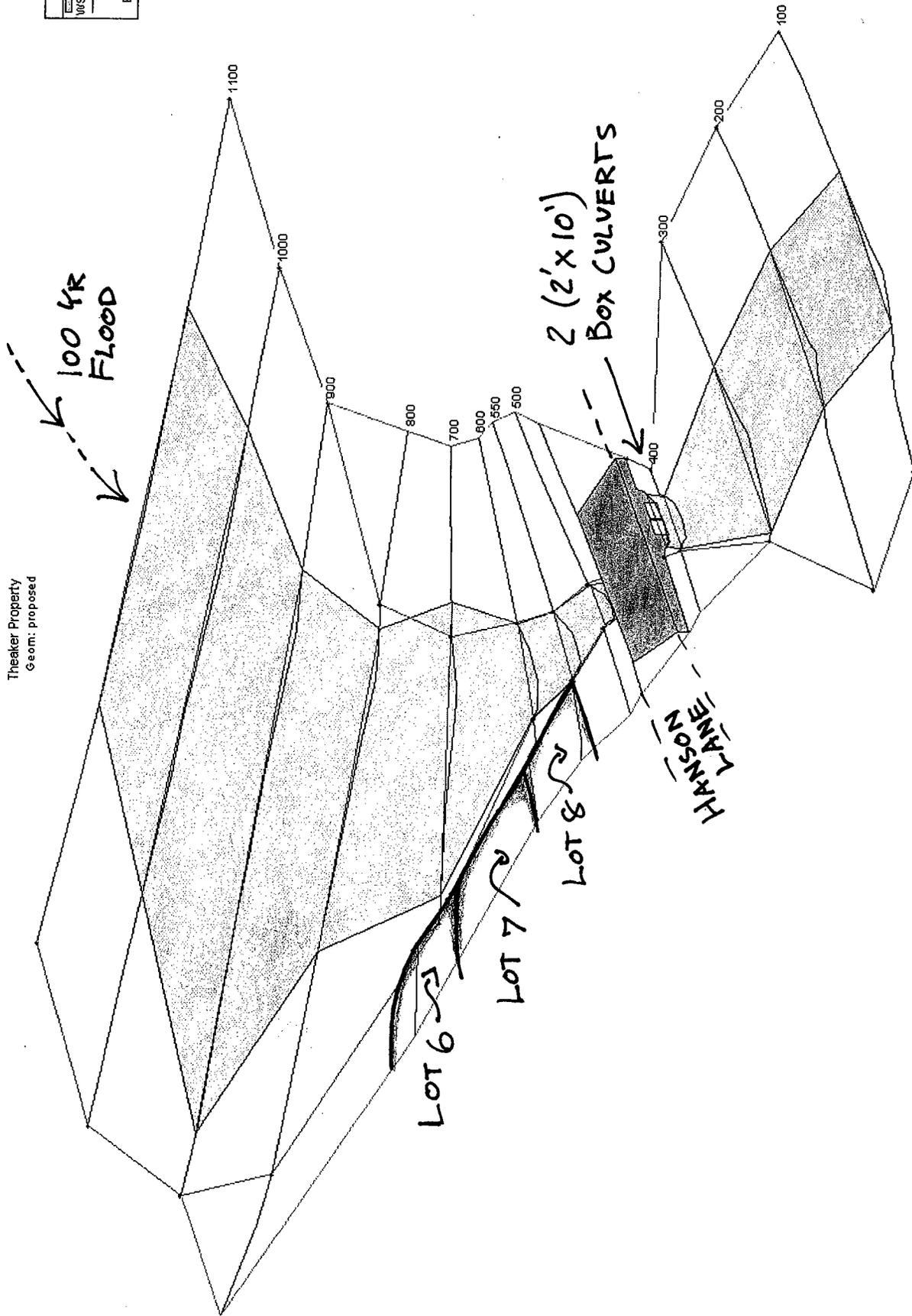
Legend	
	WWS 100 Year
	Ground
	Bank Sta



PROPOSED CONDITIONS

Theaker Property
Geom. proposed

Legend	
	WS 100 Year
	Ground
	Bank Sta



100 YR
FLOOD

2 (2'x10')
Box CULVERTS

HANSON
LANSON

LOT 6

LOT 7

LOT 8

1100

1000

900

800

700

600

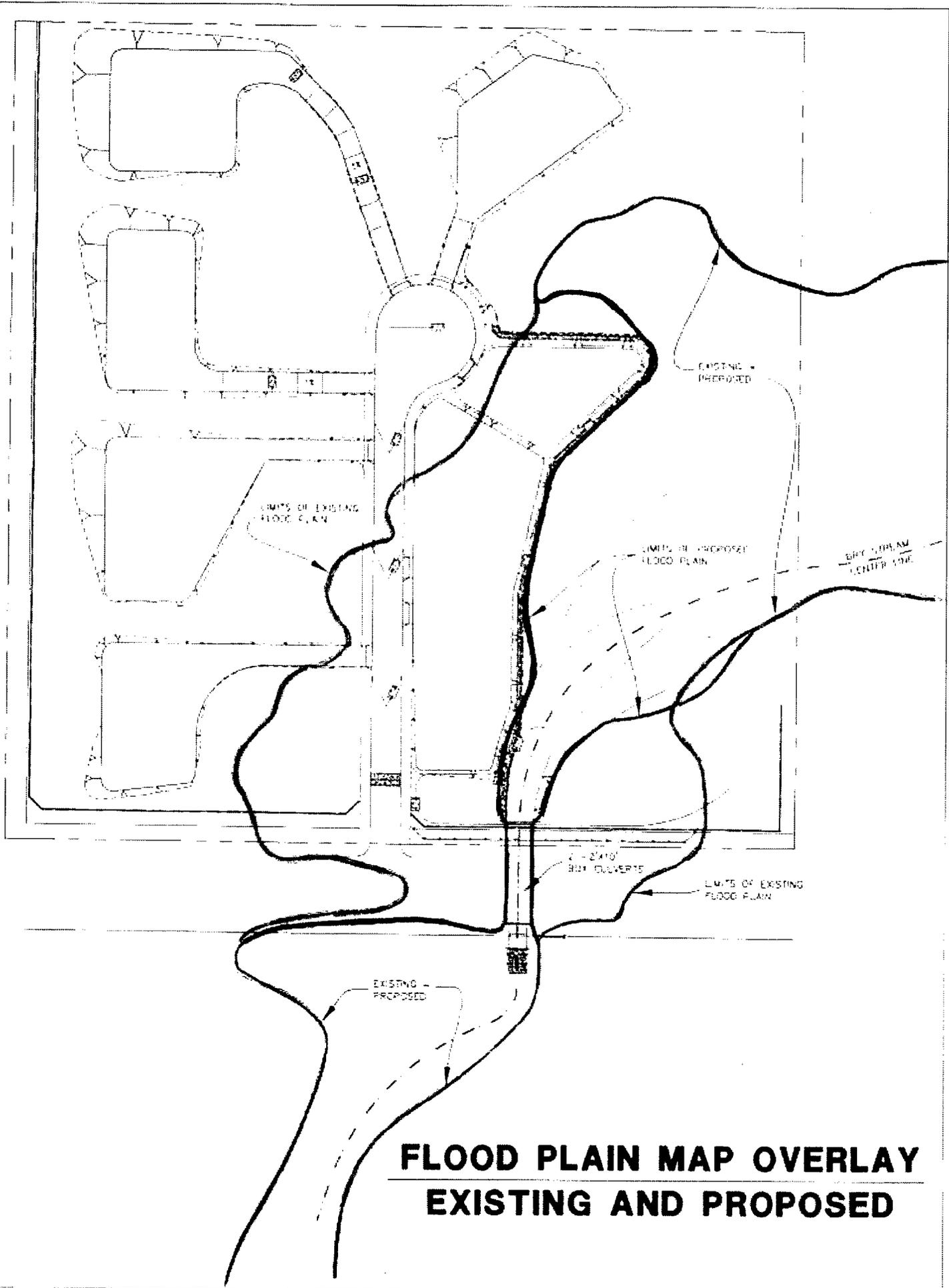
550

500

300

200

100

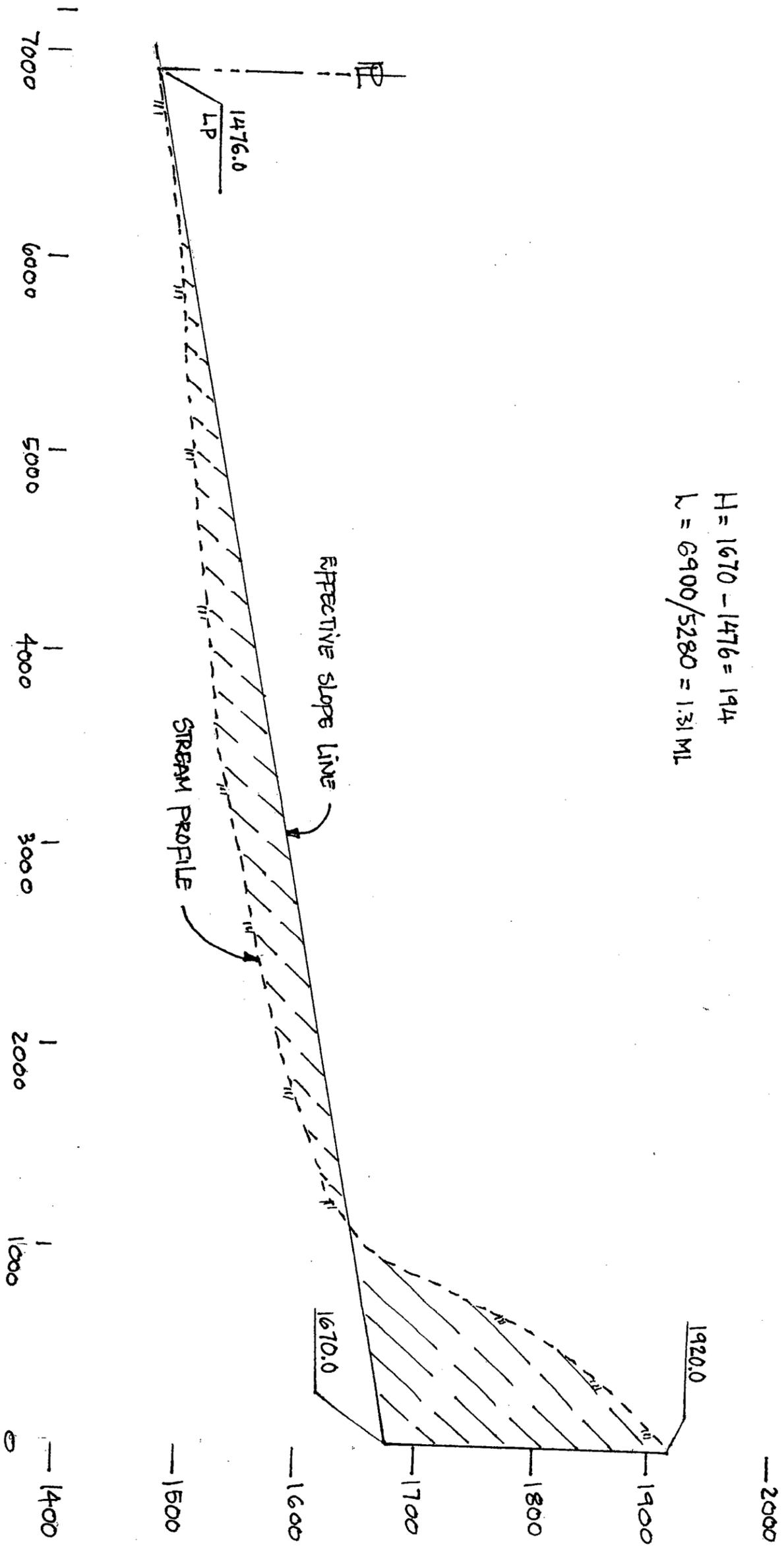


Appendix A Hydrology Calculations

HYDROLOGY CALCULATIONS

$$H = 1670 - 1476 = 194$$

$$L = 6900 / 5280 = 1.31 \text{ MI}$$



**Table 3-1
 RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

By	Date	Client	Sheet No.	Of
Checked	Date	Job	Job No.	

OFFSITE CONTRIBUTORY AREA (Q_{10})

$$L = 6900' = 1.31 \text{ mi}; \Delta E = 1670 - 1476 = 194$$

$$T_c = \left[\frac{11.9 L^3}{\Delta E} \right]^{0.385} = \left[\frac{(11.9)(1.31)^3}{194} \right]^{0.385}$$

$$= 0.466 \text{ hr} = 28 \text{ min}$$

$$\therefore L_{10} = 2.1''/\text{hr} \text{ FROM FIG 3-1}$$

$$Q_{10} = CIA = (0.41)(2.1)(157.8) = 136 \text{ CFS}$$

Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 10 year

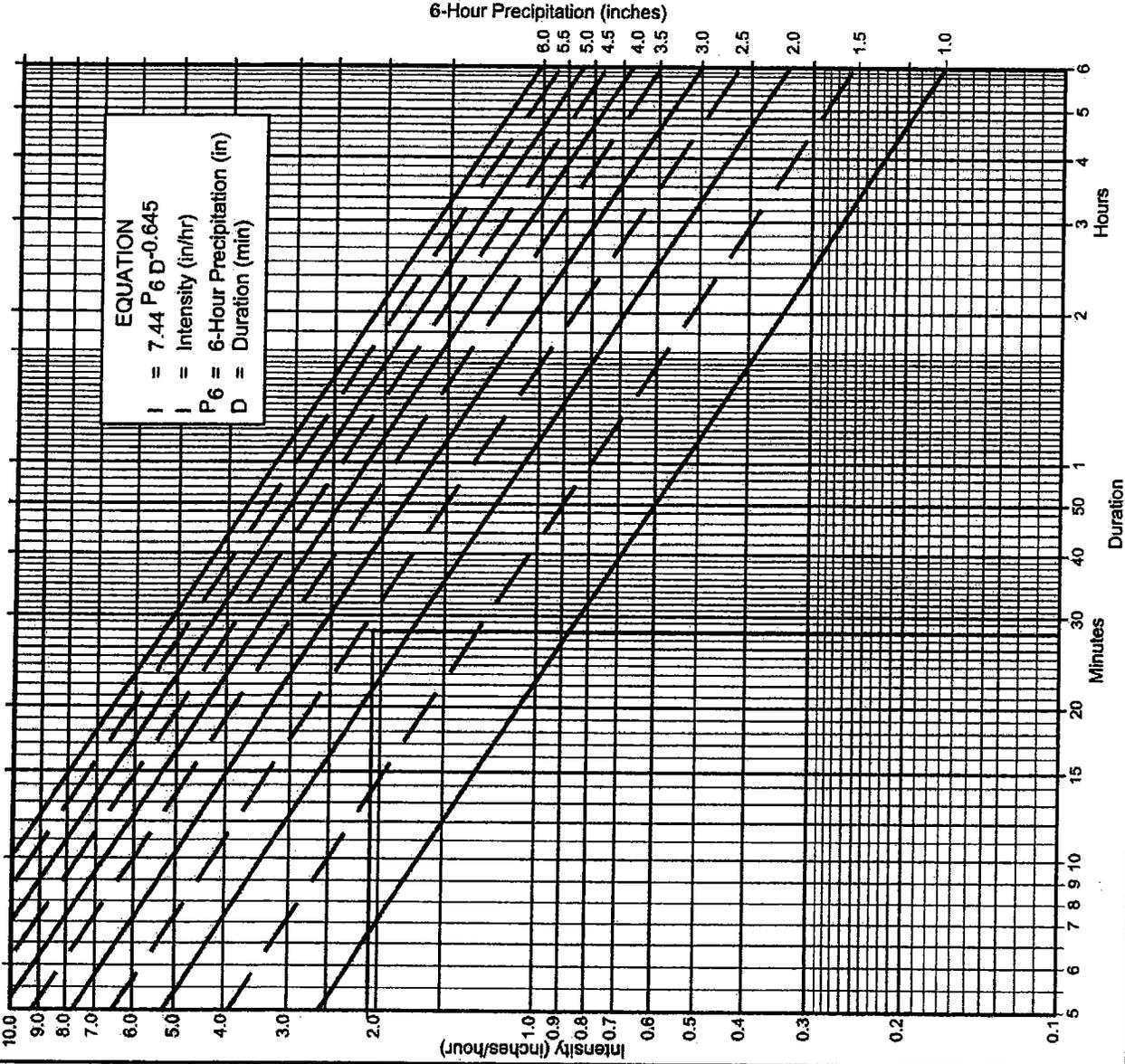
(b) $P_6 = \underline{2.4}$ in., $P_{24} = \underline{4.0}$, $\frac{P_6}{P_{24}} = \underline{0.6} \%$ (2)

(c) Adjusted $P_6^{(2)} = \underline{2.4}$ in.

(d) $t_x = \underline{28}$ min.

(e) $I = \underline{2.1}$ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.



EQUATION
 $I = 7.44 P_6 D^{-0.645}$
 I = Intensity (in/hr)
 P_6 = 6-Hour Precipitation (in)
 D = Duration (min)

6-Hour Precipitation (inches)

P6 Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.83	3.95	5.27	6.89	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.69	3.24	3.88	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.16	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.95	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.36	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

FIGURE 3-1

Intensity-Duration Design Chart - Template

County of San Diego Hydrology Manual



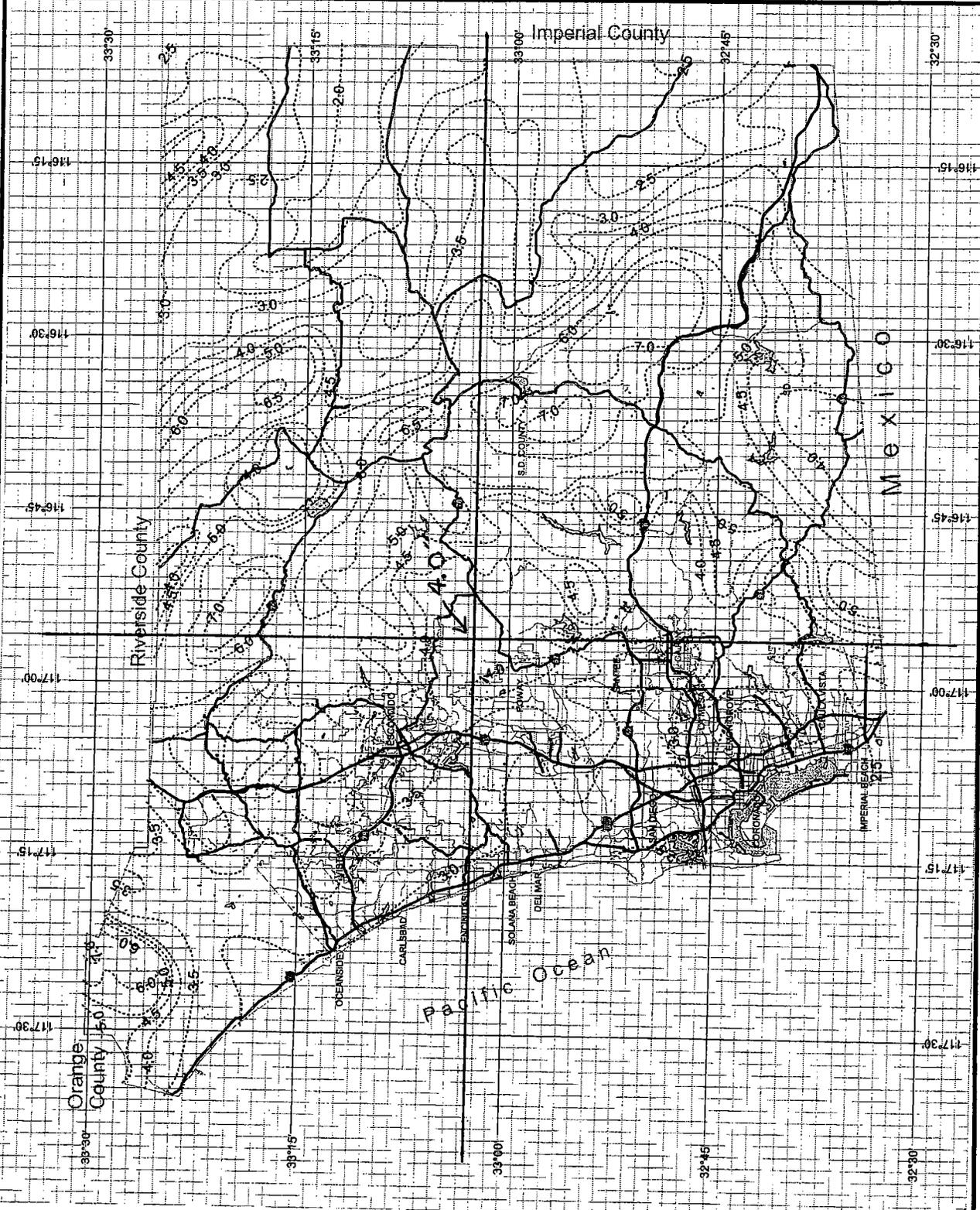
Rainfall Isopleths

10 Year Rainfall Event - 24 Hours

..... Isopleth (inches)



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County of San Diego Hydrology Manual



Rainfall Isoplethials

10 Year Rainfall Event - 6 Hours



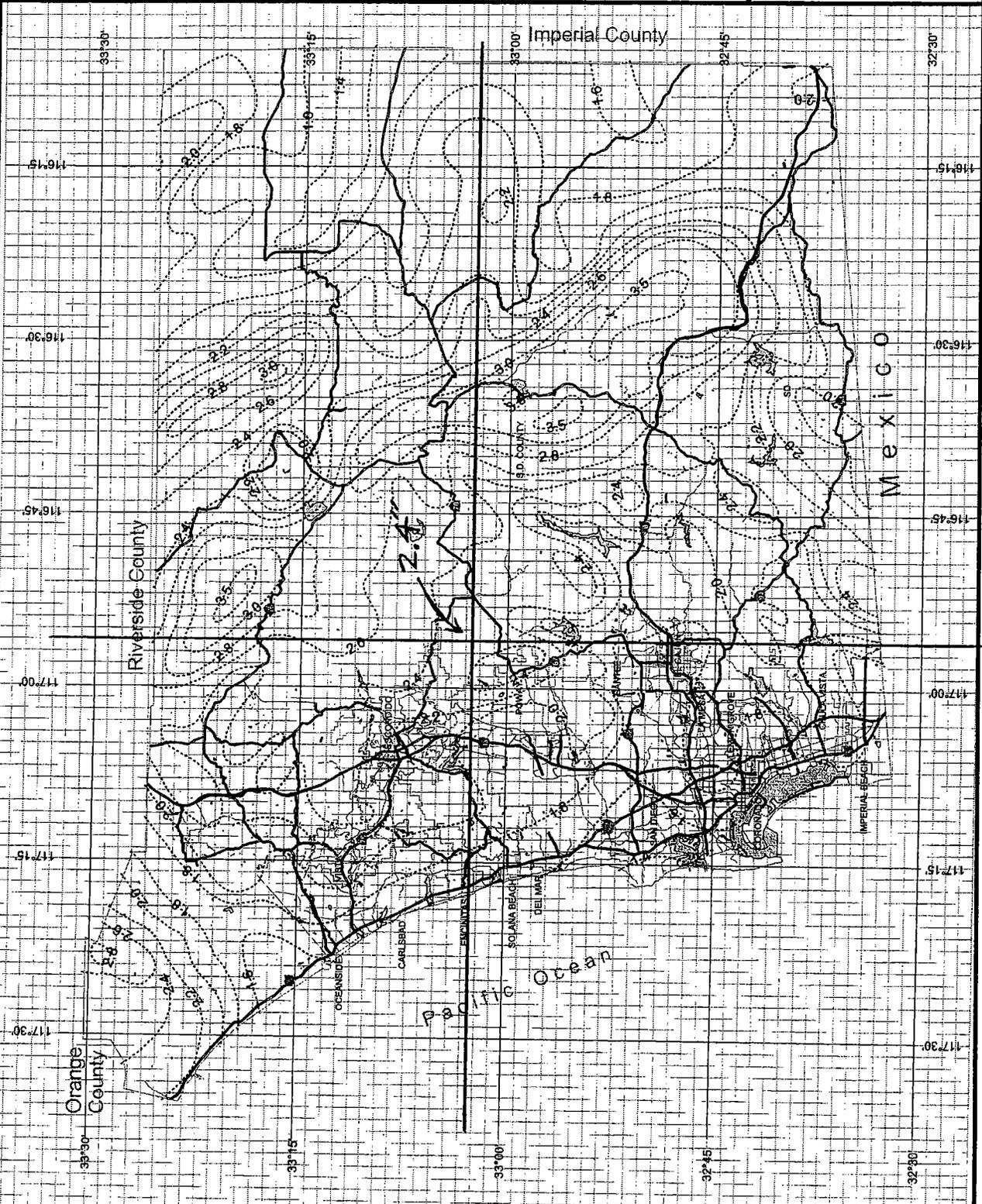
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3 0 3 Miles



OFFSITE CONTRIBUTORY AREA (Q_{100})

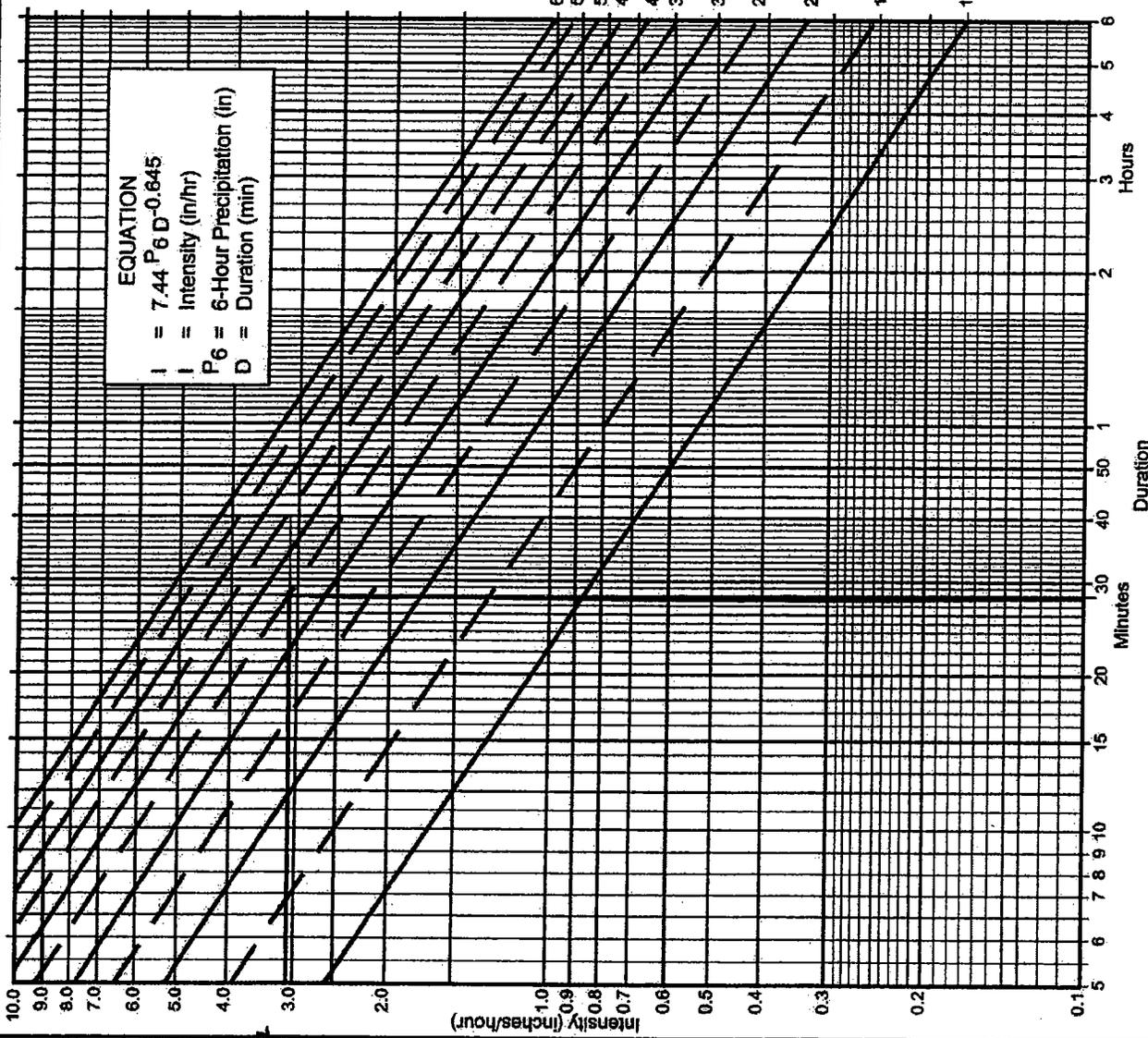
$$L = 6900' = 1.31 \text{ mi}; \Delta E = 1670 - 1476 = 194$$

$$T_c = \left[\frac{11.9L^3}{\Delta E} \right]^{0.385} = \left[\frac{(11.9)(1.31)^3}{194} \right]^{0.385}$$

$$= 0.466 \text{ HR} = 28 \text{ min}$$

$$L' = 3.04 \text{ FROM FIG 3-1}$$

$$Q_{100} = CIA = (0.41)(3.04)(157.8) = 197 \text{ CFS}$$



Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

- (a) Selected frequency / 0.0 year
- (b) $P_6 = \underline{3.5}$ in., $P_{24} = \underline{6.0}$, $\frac{P_6}{P_{24}} = \underline{58\%}$ (2)
- (c) Adjusted $P_6^{(2)} = \underline{3.5}$ in.
- (d) $t_x = \underline{28}$ min.
- (e) $I = \underline{3.04}$ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.69	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.95	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.36	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

FIGURE
3-1

Intensity-Duration Design Chart - Template

County of San Diego Hydrology Manual



Rainfall Isopleths

100 Year Rainfall Event - 6 Hours

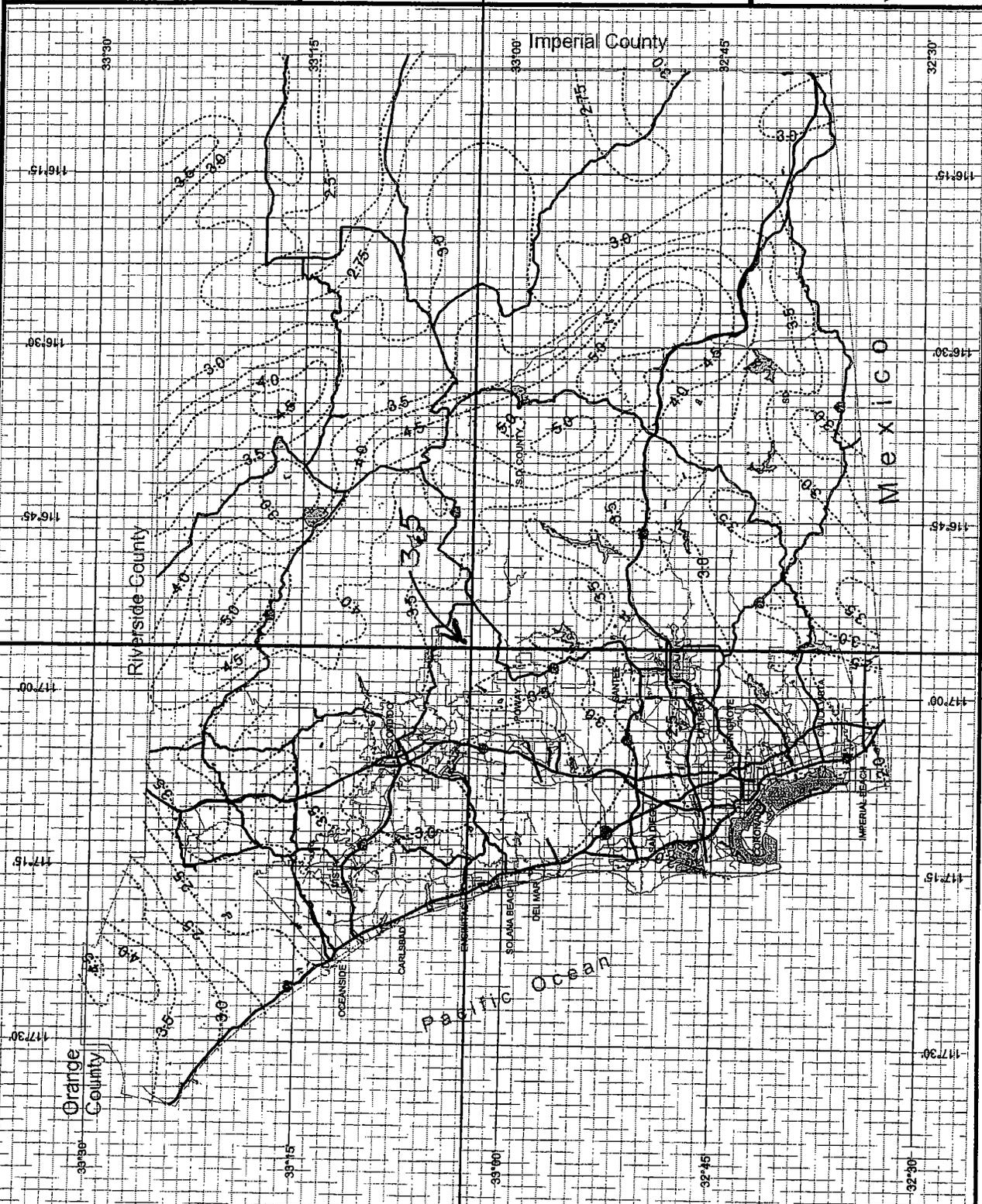
..... Isopleth (inches)



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County of San Diego Hydrology Manual



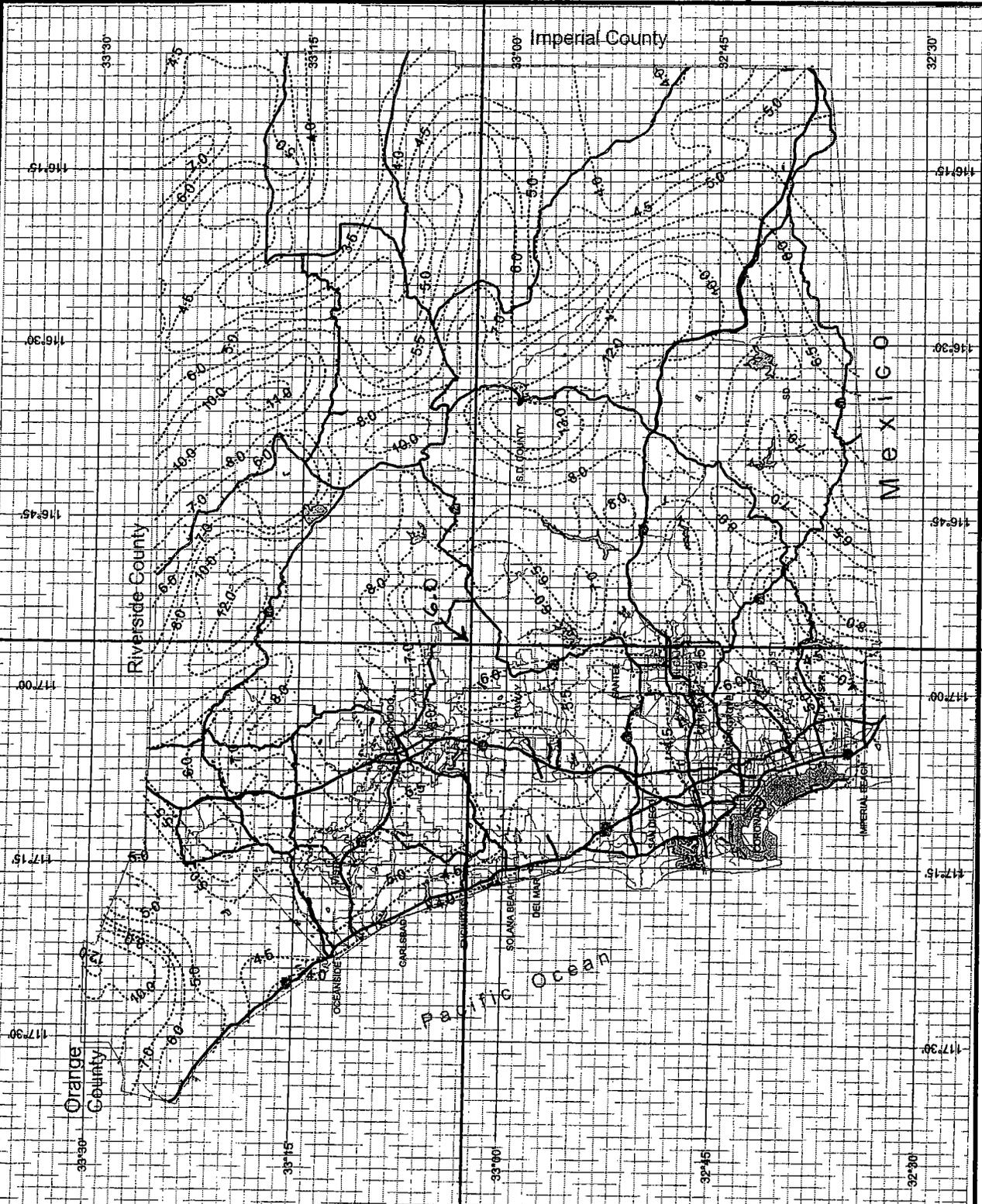
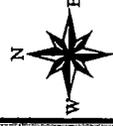
Rainfall Isophovials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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EXISTING HYDROLOGY Q(10)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2003 Version

7.3

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/14/04

Theaker Subd Existing Hydrology

***** Hydrology Study Control Information *****

P & D Consultants - S/N 715

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.400
24 hour precipitation(inches) = 4.000
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

++++

Process from Point/Station 100.000 to Point/Station
200.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.041 given for subarea
Rainfall intensity (I) = 2.081(In/Hr) for a 10.0 year
storm

User specified values are as follows:
TC = 28.00 min. Rain intensity = 2.08(In/Hr)
Total area = 157.800(Ac.) Total runoff = 136.000(CFS)

++++

Process from Point/Station 200.000 to Point/Station
200.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 2.081(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 70.233

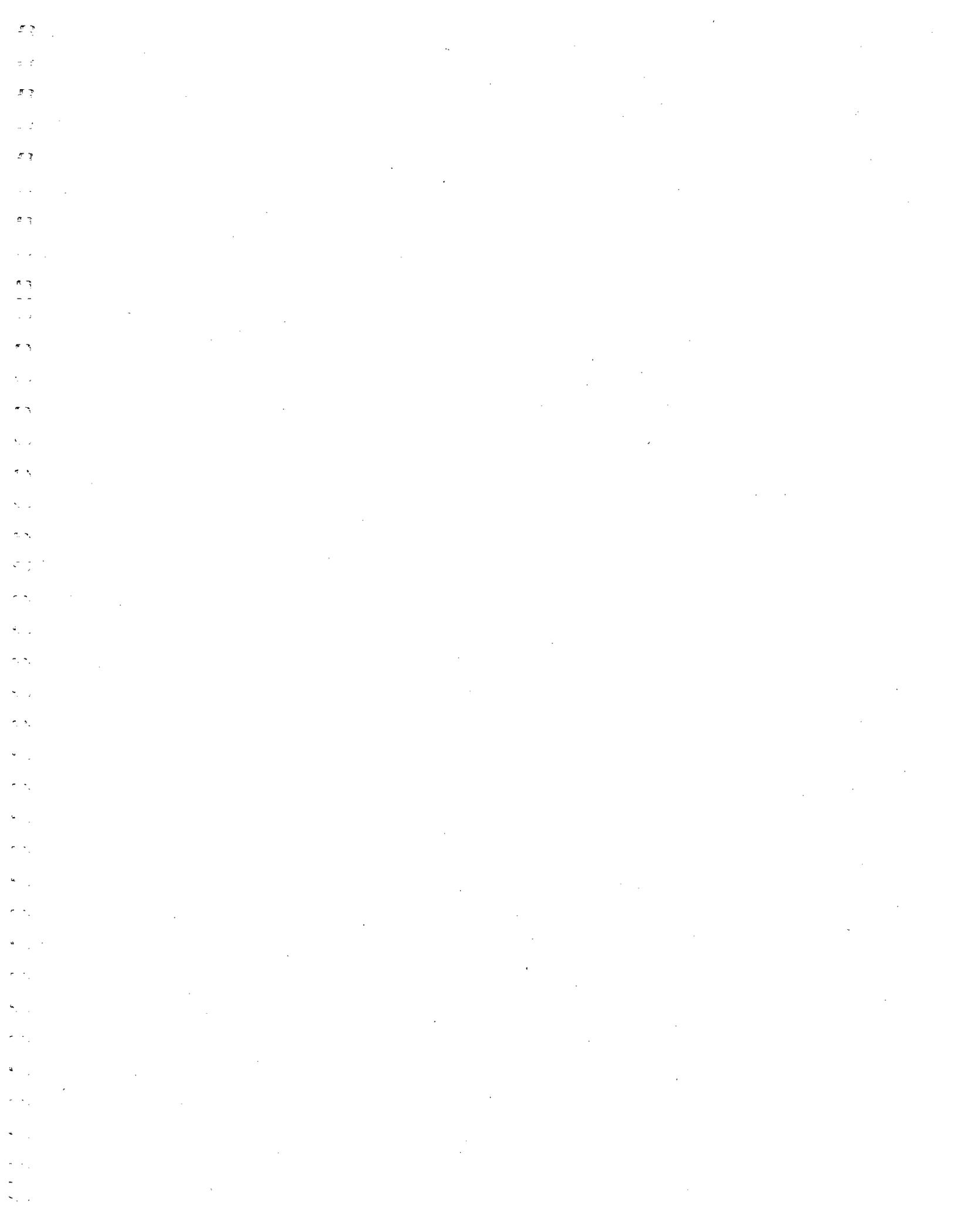
Subarea runoff = 10.187(CFS) for 13.500(Ac.)
Total runoff = 146.187(CFS) Total area = 171.300(Ac.)

++++
300.000 Process from Point/Station 200.000 to Point/Station
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 2.081(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 70.807
Subarea runoff = 1.195(CFS) for 1.400(Ac.)
Total runoff = 147.382(CFS) Total area = 172.700(Ac.)

++++
300.000 Process from Point/Station 200.000 to Point/Station
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 2.081(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 74.620
Subarea runoff = 7.937(CFS) for 9.300(Ac.)
Total runoff = 155.318(CFS) Total area = 182.000(Ac.)
End of computations, total study area = 182.000 (Ac.)



PROPOSED HYDROLOGY Q(10)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1991-2003 Version

7.3

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/14/04

Theaker Subd Developed Hydrology

(TheakerProp)

***** Hydrology Study Control Information *****

P & D Consultants - S/N 715

Rational hydrology study storm event year is 10.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.400
24 hour precipitation(inches) = 4.000
P6/P24 = 60.0%
San Diego hydrology manual 'C' values used

++++
Process from Point/Station 100.000 to Point/Station
150.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance = 320.000 (Ft.)
Highest elevation = 1493.000 (Ft.)
Lowest elevation = 1479.000 (Ft.)
Elevation difference = 14.000 (Ft.) Slope = 4.375 %
Top of Initial Area Slope adjusted by User to 4.400 %
Bottom of Initial Area Slope adjusted by User to 4.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 4.40 %, in a development type of
1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 7.58 minutes

$TC = [1.8*(1.1-C)*distance(Ft.)^{.5}/(%\ slope^{(1/3)})]$
 $TC = [1.8*(1.1-0.4100)*(100.000^{.5})/(4.400^{(1/3)})] = 7.58$
 The initial area total distance of 320.00 (Ft.) entered leaves a remaining distance of 220.00 (Ft.)
 Using Figure 3-4, the travel time for this distance is 1.65 minutes
 for a distance of 220.00 (Ft.) and a slope of 4.40 %
 with an elevation difference of 9.68 (Ft.) from the end of the top area
 $Tt = [11.9*length(Mi)^3]/(elevation\ change(Ft.))^{.385} *60\ (min/hr)$
 $= 1.654\ Minutes$
 $Tt = [(11.9*0.0417^3)/(9.68)]^{.385} = 1.65$
 Total initial area Ti = 7.58 minutes from Figure 3-3 formula
 plus
 1.65 minutes from the Figure 3-4 formula = 9.23 minutes
 Rainfall intensity (I) = 4.257 (In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
 Subarea runoff = 1.745 (CFS)
 Total initial stream area = 1.000 (Ac.)

+++++
 +***
 Process from Point/Station 100.000 to Point/Station
 150.000
 **** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
 Time of concentration = 9.23 min.
 Rainfall intensity = 4.257 (In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area (Q=KCIA) is C = 0.410 CA = 0.984
 Subarea runoff = 2.444 (CFS) for 1.400 (Ac.)
 Total runoff = 4.189 (CFS) Total area = 2.400 (Ac.)

+++++
 +***
 Process from Point/Station 150.000 to Point/Station
 300.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1479.000 (Ft.)
 End of street segment elevation = 1474.000 (Ft.)
 Length of street segment = 370.000 (Ft.)
 Height of curb above gutter flowline = 6.0 (In.)
 Width of half street (curb to crown) = 20.000 (Ft.)
 Distance from crown to crossfall grade break = 18.900 (Ft.)
 Slope from gutter to grade break (v/hz) = 0.020
 Slope from grade break to crown (v/hz) = 0.020
 Street flow is on [2] side(s) of the street
 Distance from curb to property line = 10.000 (Ft.)
 Slope from curb to property line (v/hz) = 0.025
 Gutter width = 1.500 (Ft.)
 Gutter hike from flowline = 1.500 (In.)
 Manning's N in gutter = 0.0150
 Manning's N from gutter to grade break = 0.0150
 Manning's N from grade break to crown = 0.0150

Estimated mean flow rate at midpoint of street = 6.497 (CFS)
 Depth of flow = 0.310 (Ft.), Average velocity = 2.655 (Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width = 10.734 (Ft.)
 Flow velocity = 2.66 (Ft/s)
 Travel time = 2.32 min. TC = 11.56 min.
 Adding area flow to street
 User specified 'C' value of 0.900 given for subarea
 Rainfall intensity = 3.684 (In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.900 CA = 2.430
 Subarea runoff = 4.762 (CFS) for 0.300 (Ac.)
 Total runoff = 8.951 (CFS) Total area = 2.700 (Ac.)
 Street flow at end of street = 8.951 (CFS)
 Half street flow at end of street = 4.476 (CFS)
 Depth of flow = 0.339 (Ft.), Average velocity = 2.869 (Ft/s)
 Flow width (from curb towards crown) = 12.202 (Ft.)

+++++

 Process from Point/Station 150.000 to Point/Station
 300.000
 **** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
 Time of concentration = 11.56 min.
 Rainfall intensity = 3.684 (In/Hr) for a 10.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.410 CA = 4.387
 Subarea runoff = 7.209 (CFS) for 8.000 (Ac.)
 Total runoff = 16.160 (CFS) Total area = 10.700 (Ac.)

+++++

 Process from Point/Station 150.000 to Point/Station
 300.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 10.700 (Ac.)
 Runoff from this stream = 16.160 (CFS)
 Time of concentration = 11.56 min.
 Rainfall intensity = 3.684 (In/Hr)

+++++

 Process from Point/Station 200.000 to Point/Station
 300.000
 **** USER DEFINED FLOW INFORMATION AT A POINT ****

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [LOW DENSITY RESIDENTIAL]

(1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.410
 Rainfall intensity (I) = 2.081(In/Hr) for a 10.0 year storm

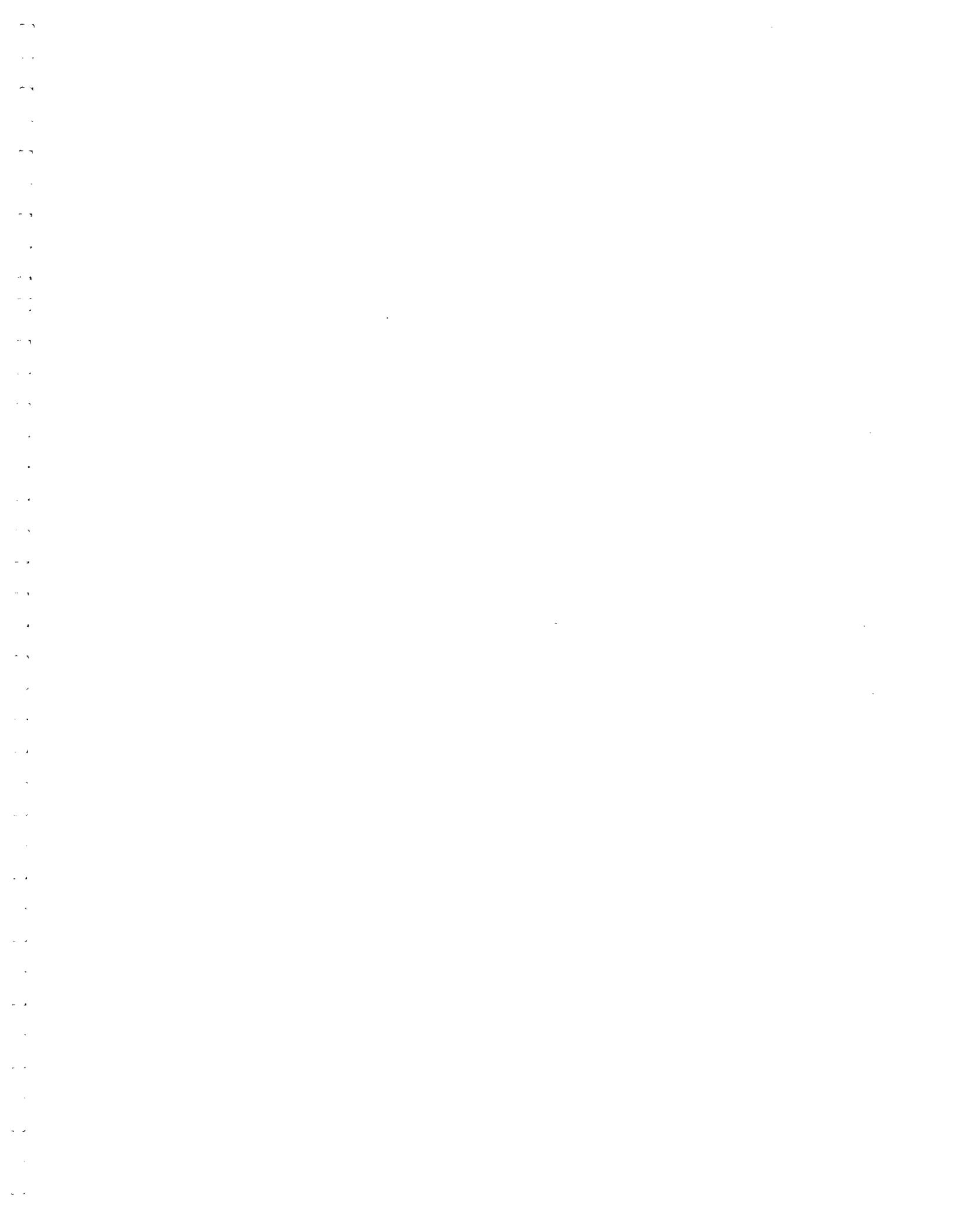
User specified values are as follows:
 TC = 28.00 min. Rain intensity = 2.08(In/Hr)
 Total area = 171.300(Ac.) Total runoff = 146.000(CFS)

++++
 Process from Point/Station 200.000 to Point/Station 300.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 171.300(Ac.)
 Runoff from this stream = 146.000(CFS)
 Time of concentration = 28.00 min.
 Rainfall intensity = 2.081(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	16.160	11.56	3.684
2	146.000	28.00	2.081
Qmax(1) =			
	1.000 *	1.000 *	16.160) +
	1.000 *	0.413 *	146.000) + = 76.416
Qmax(2) =			
	0.565 *	1.000 *	16.160) +
	1.000 *	1.000 *	146.000) + = 155.131

Total of 2 streams to confluence:
 Flow rates before confluence point:
 16.160 146.000
 Maximum flow rates at confluence using above data:
 76.416 155.131
 Area of streams before confluence:
 10.700 171.300
 Results of confluence:
 Total flow rate = 155.131(CFS)
 Time of concentration = 28.000 min.
 Effective stream area after confluence = 182.000(Ac.)
 End of computations, total study area = 182.000 (Ac.)



EXISTING HYDROLOGY Q(100)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2003 Version

7.3

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/15/04

Theaker Subd Existing Hydrology

theakerexisting100yr

***** Hydrology Study Control Information *****

P & D Consultants - S/N 715

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 6.000
P6/P24 = 58.3%
San Diego hydrology manual 'C' values used

++++

Process from Point/Station 100.000 to Point/Station
200.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.410 given for subarea
Rainfall intensity (I) = 3.035(In/Hr) for a 100.0 year
storm
User specified values are as follows:
TC = 28.00 min. Rain intensity = 3.04(In/Hr)
Total area = 157.800(Ac.) Total runoff = 197.000(CFS)

++++

Process from Point/Station 200.000 to Point/Station
200.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 3.035(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 70.233

Subarea runoff = 16.189(CFS) for 13.500(Ac.)
Total runoff = 213.189(CFS) Total area = 171.300(Ac.)

++++
300.000 Process from Point/Station 200.000 to Point/Station
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 3.035(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 70.807
Subarea runoff = 1.742(CFS) for 1.400(Ac.)
Total runoff = 214.932(CFS) Total area = 172.700(Ac.)

++++
300.000 Process from Point/Station 200.000 to Point/Station
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 28.00 min.
Rainfall intensity = 3.035(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 74.620
Subarea runoff = 11.574(CFS) for 9.300(Ac.)
Total runoff = 226.506(CFS) Total area = 182.000(Ac.)
End of computations, total study area = 182.000 (Ac.)

PROPOSED HYDROLOGY Q(100)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2003 Version

7.3

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/15/04

Theaker Subd Developed Condition
100 year storm event
(theakerprop)

***** Hydrology Study Control Information *****

P & D Consultants - S/N 715

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 6.000
P6/P24 = 58.3%
San Diego hydrology manual 'C' values used

++++

Process from Point/Station 100.000 to Point/Station
150.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance = 320.000(Ft.)
Highest elevation = 1493.000(Ft.)
Lowest elevation = 1479.000(Ft.)
Elevation difference = 14.000(Ft.) Slope = 4.375 %
Top of Initial Area Slope adjusted by User to 4.400 %
Bottom of Initial Area Slope adjusted by User to 4.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 4.40 %, in a development type of
1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 7.58 minutes

TC = [1.8*(1.1-C)*distance(Ft.)^{1.5}/(% slope^{1/3})]
TC = [1.8*(1.1-0.4100)*(100.000^{1.5})/(4.400^{1/3})] = 7.58
The initial area total distance of 320.00 (Ft.) entered leaves a remaining distance of 220.00 (Ft.)

Using Figure 3-4, the travel time for this distance is 1.65 minutes
for a distance of 220.00 (Ft.) and a slope of 4.40 %
with an elevation difference of 9.68(Ft.) from the end of the top area

Tt = [11.9*length(Mi)³/(elevation change(Ft.))]^{0.385} *60(min/hr)
= 1.654 Minutes
Tt=[(11.9*0.0417³)/(9.68)]^{0.385} = 1.65
Total initial area Ti = 7.58 minutes from Figure 3-3 formula

plus
1.65 minutes from the Figure 3-4 formula = 9.23 minutes
Rainfall intensity (I) = 6.208(In/Hr) for a 100.0 year storm

storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff = 2.545(CFS)
Total initial stream area = 1.000(Ac.)

++++
Process from Point/Station 100.000 to Point/Station
150.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 9.23 min.
Rainfall intensity = 6.208(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area (Q=KCIA) is C = 0.410 CA = 0.984
Subarea runoff = 3.564(CFS) for 1.400(Ac.)
Total runoff = 6.109(CFS) Total area = 2.400(Ac.)

++++
Process from Point/Station 150.000 to Point/Station
300.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1479.000(Ft.)
End of street segment elevation = 1474.000(Ft.)
Length of street segment = 370.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 20.000(Ft.)
Distance from crown to crossfall grade break = 18.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 10.000(Ft.)
Slope from curb to property line (v/hz) = 0.025
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Estimated mean flow rate at midpoint of street = 9.604 (CFS)
Depth of flow = 0.346 (Ft.), Average velocity = 2.918 (Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 12.547 (Ft.)
Flow velocity = 2.92 (Ft/s)
Travel time = 2.11 min. TC = 11.35 min.
Adding area flow to street
User specified 'C' value of 0.900 given for subarea
Rainfall intensity = 5.436 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.900 CA = 2.430
Subarea runoff = 7.100 (CFS) for 0.300 (Ac.)
Total runoff = 13.209 (CFS) Total area = 2.700 (Ac.)
Street flow at end of street = 13.209 (CFS)
Half street flow at end of street = 6.604 (CFS)
Depth of flow = 0.379 (Ft.), Average velocity = 3.154 (Ft/s)
Flow width (from curb towards crown) = 14.222 (Ft.)

++++
Process from Point/Station 150.000 to Point/Station
300.000
**** SUBAREA FLOW ADDITION ****

User specified 'C' value of 0.410 given for subarea
Time of concentration = 11.35 min.
Rainfall intensity = 5.436 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410 CA = 4.387
Subarea runoff = 10.638 (CFS) for 8.000 (Ac.)
Total runoff = 23.846 (CFS) Total area = 10.700 (Ac.)

++++
Process from Point/Station 150.000 to Point/Station
300.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 10.700 (Ac.)
Runoff from this stream = 23.846 (CFS)
Time of concentration = 11.35 min.
Rainfall intensity = 5.436 (In/Hr)

++++
Process from Point/Station 200.000 to Point/Station
300.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL]

(1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.410
 Rainfall intensity (I) = 3.035(In/Hr) for a 100.0 year

storm

User specified values are as follows:
 TC = 28.00 min. Rain intensity = 3.04(In/Hr)
 Total area = 171.300(Ac.) Total runoff = 215.000(CFS)

++++
 Process from Point/Station 200.000 to Point/Station
 300.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 171.300(Ac.)
 Runoff from this stream = 215.000(CFS)
 Time of concentration = 28.00 min.
 Rainfall intensity = 3.035(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	23.846	11.35	5.436
2	215.000	28.00	3.035
Qmax(1) =			
	1.000 *	1.000 *	23.846) +
	1.000 *	0.405 *	215.000) + = 110.972
Qmax(2) =			
	0.558 *	1.000 *	23.846) +
	1.000 *	1.000 *	215.000) + = 228.317

Total of 2 streams to confluence:
 Flow rates before confluence point:
 23.846 215.000
 Maximum flow rates at confluence using above data:
 110.972 228.317
 Area of streams before confluence:
 10.700 171.300
 Results of confluence:
 Total flow rate = 228.317(CFS)
 Time of concentration = 28.000 min.
 Effective stream area after confluence = 182.000(Ac.)
 End of computations, total study area = 182.000 (Ac.)

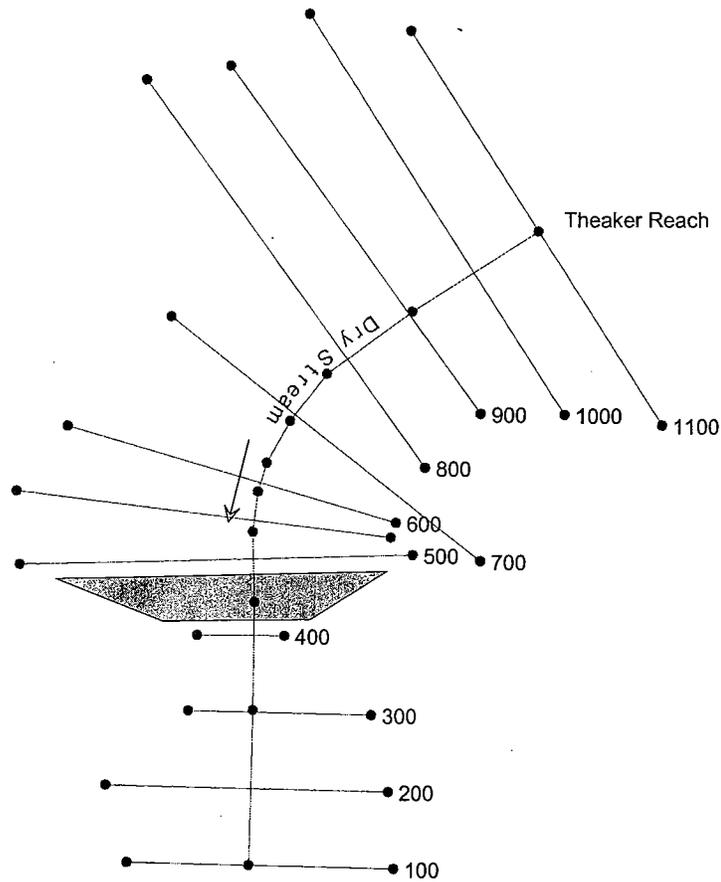
Appendix B

Existing Conditions

HEC-RAS
FLOOD PLAN STUDY

EXISTING CONDITIONS

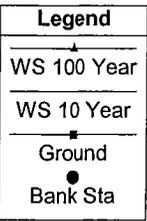
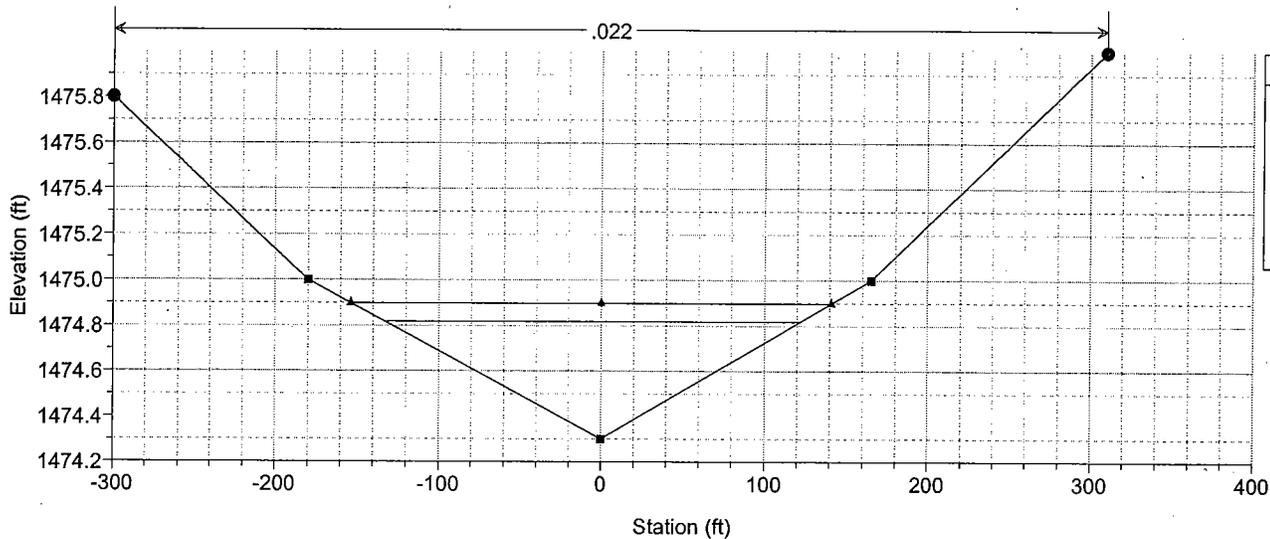
EXISTING CONDITIONS



Theaker Property

Geom: existing rev

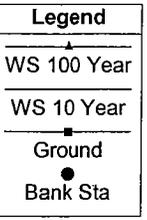
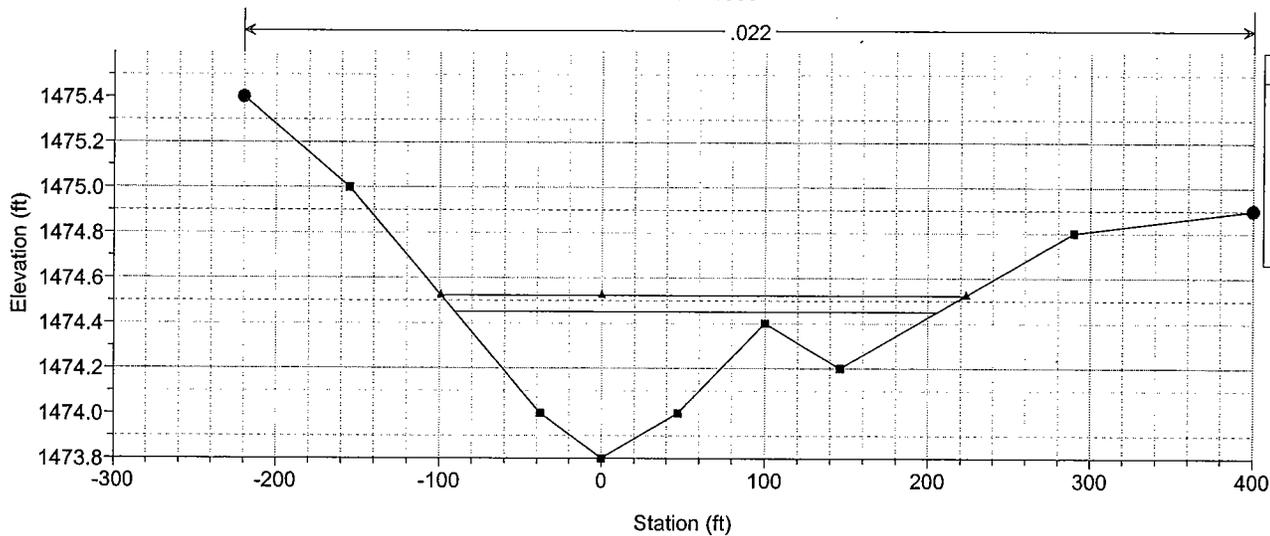
RS = 1100



Theaker Property

Geom: existing rev

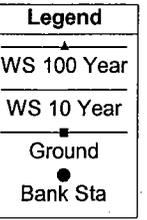
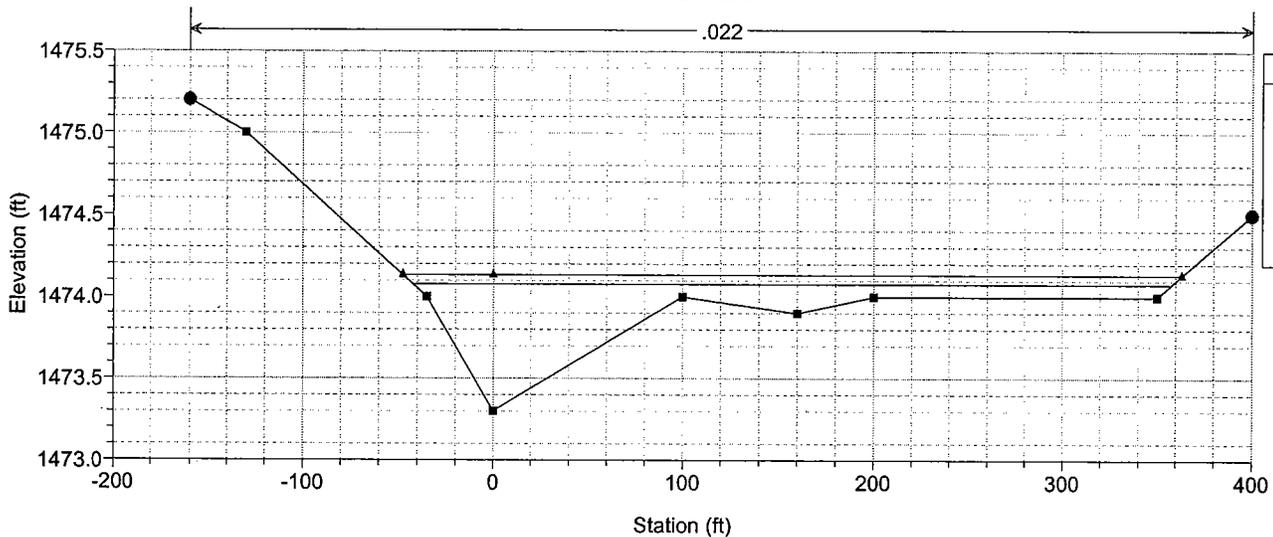
RS = 1000



Theaker Property

Geom: existing rev

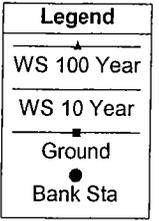
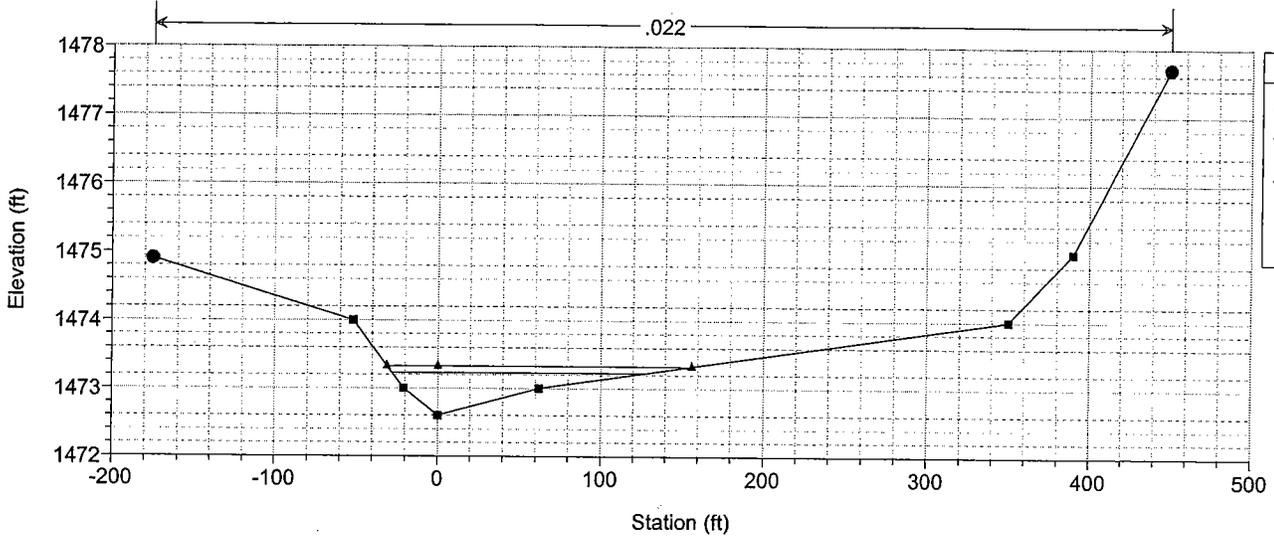
RS = 900



Theaker Property

Geom: existing rev

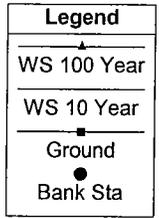
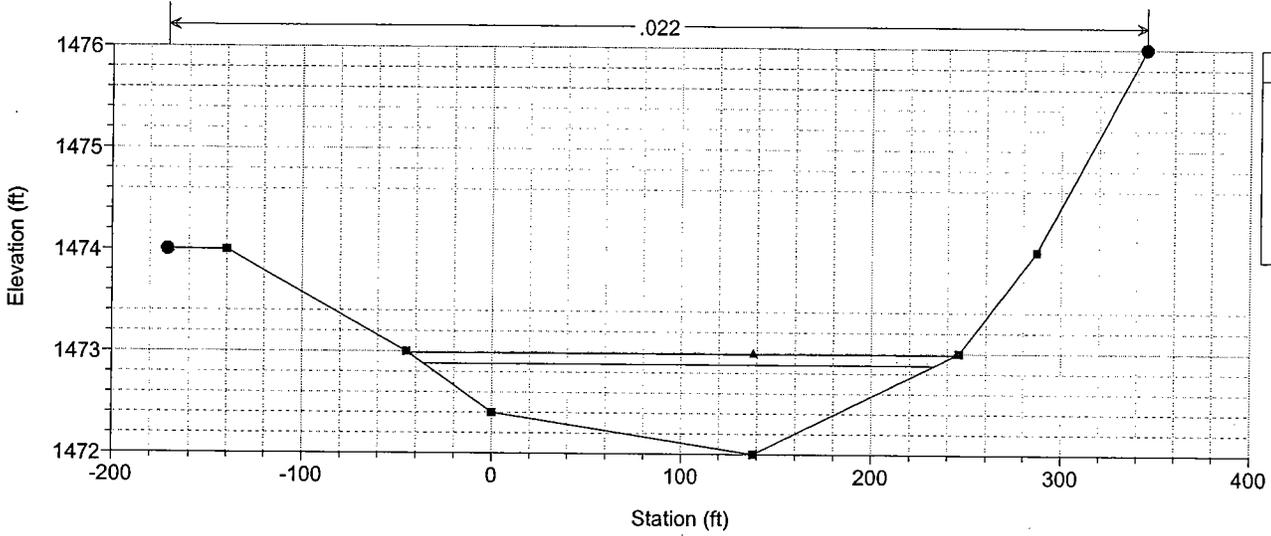
RS = 800



Theaker Property

Geom: existing rev

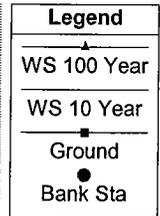
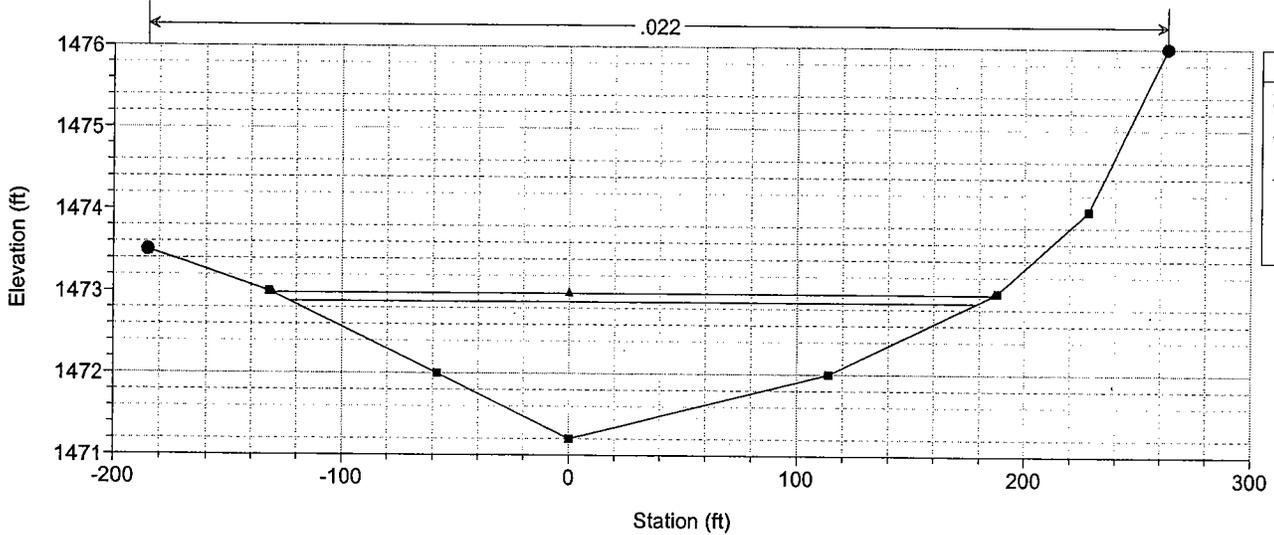
RS = 700



Theaker Property

Geom: existing rev

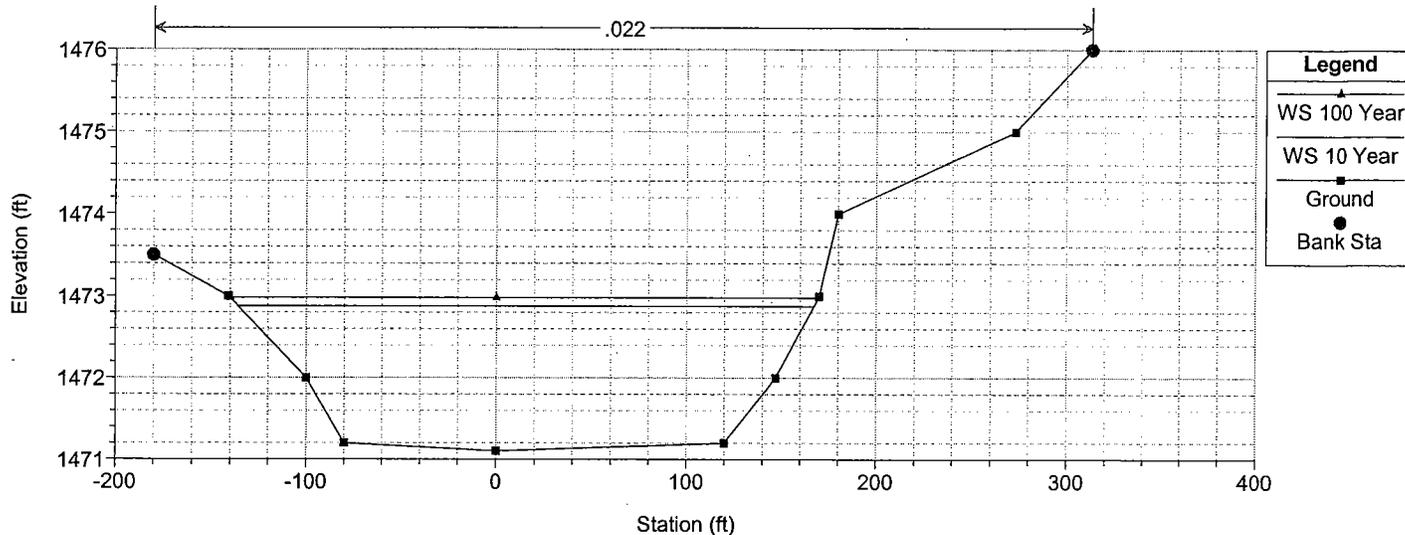
RS = 600



Theaker Property

Geom: existing rev

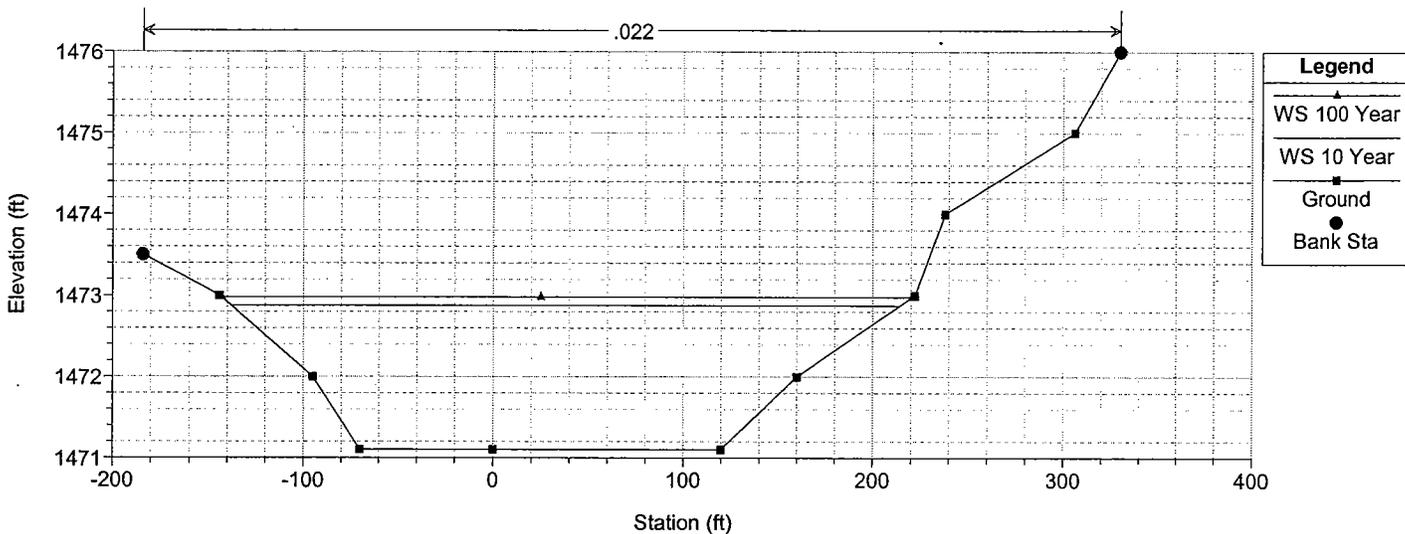
RS = 550



Theaker Property

Geom: existing rev

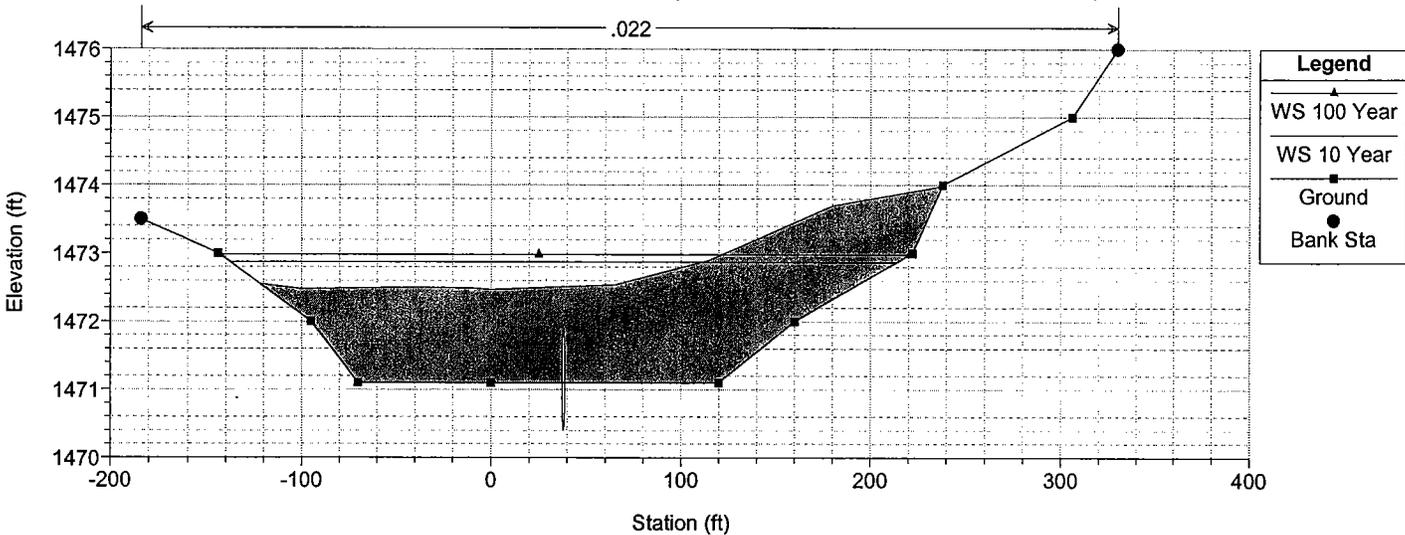
RS = 500



Theaker Property

Geom: existing rev

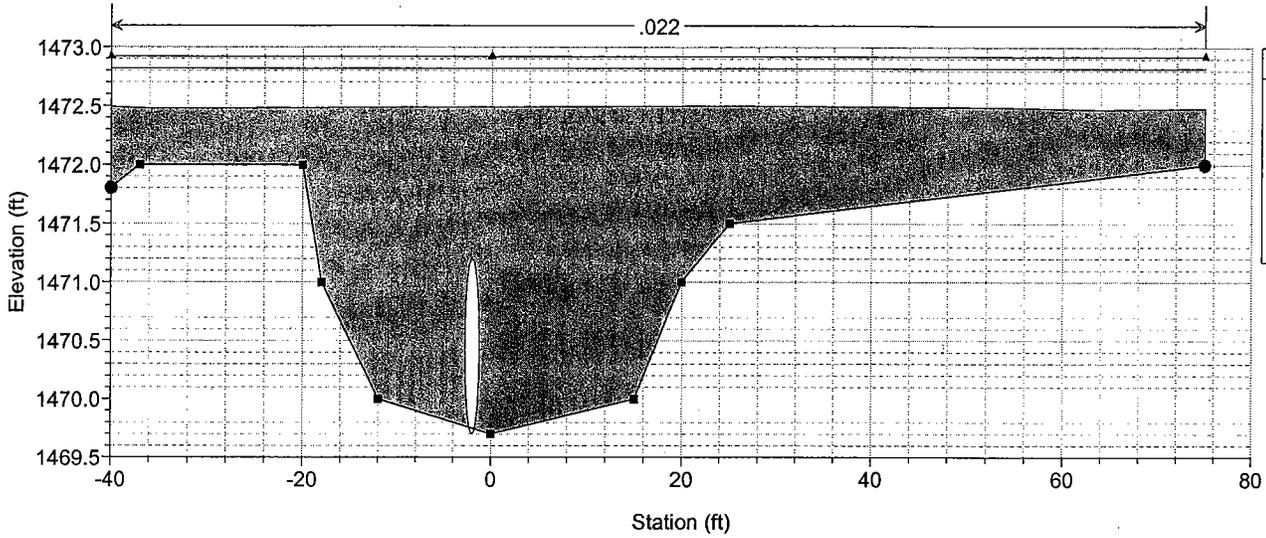
RS = 450 Culv Pipe Culvert Under Hanson Lane



Theaker Property

Geom: existing rev

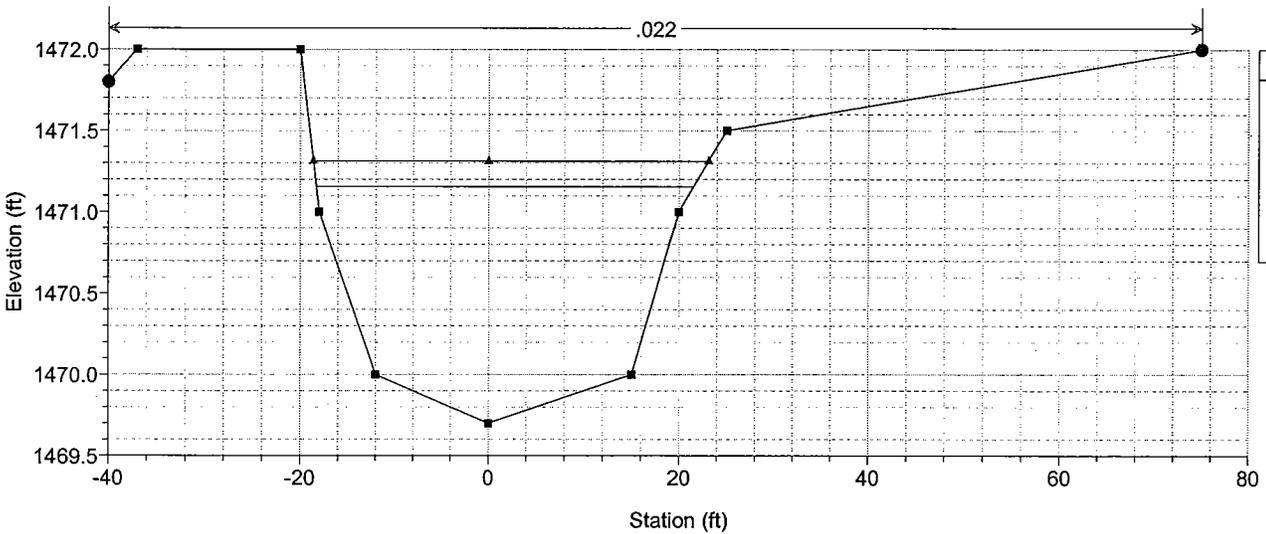
RS = 450 Culv Pipe Culvert Under Hanson Lane



Theaker Property

Geom: existing rev

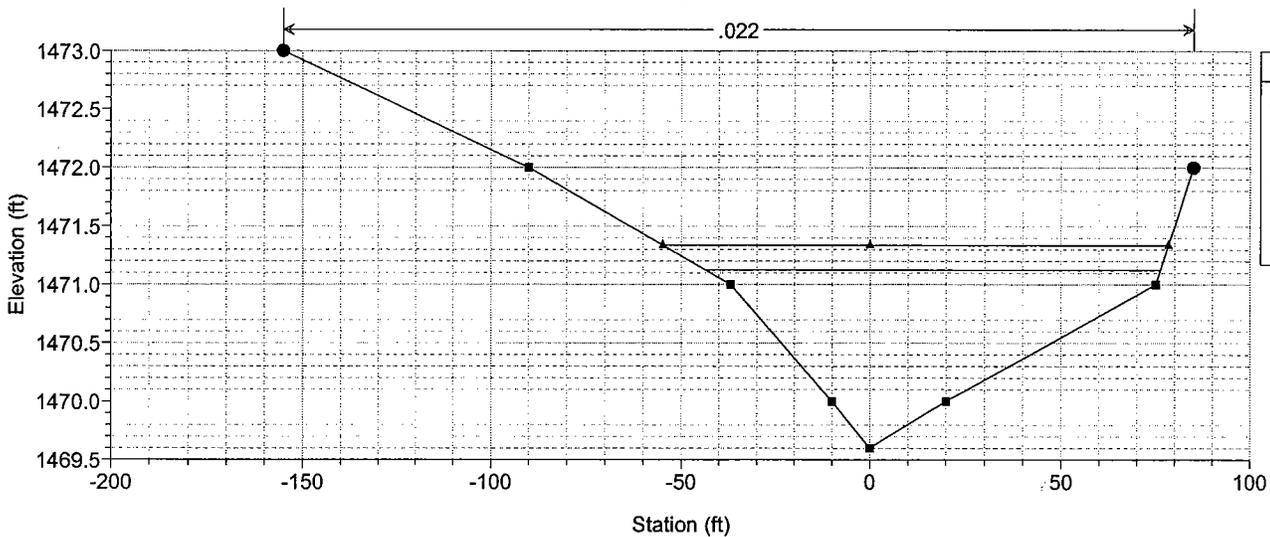
RS = 400



Theaker Property

Geom: existing rev

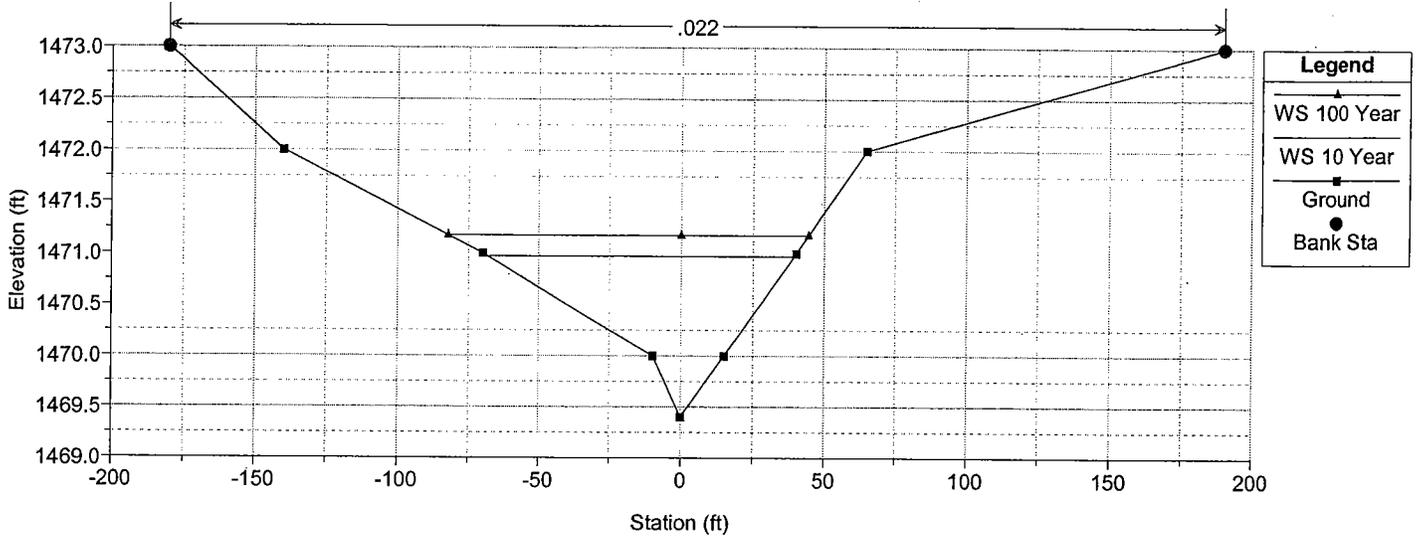
RS = 300



Theaker Property

Geom: existing rev

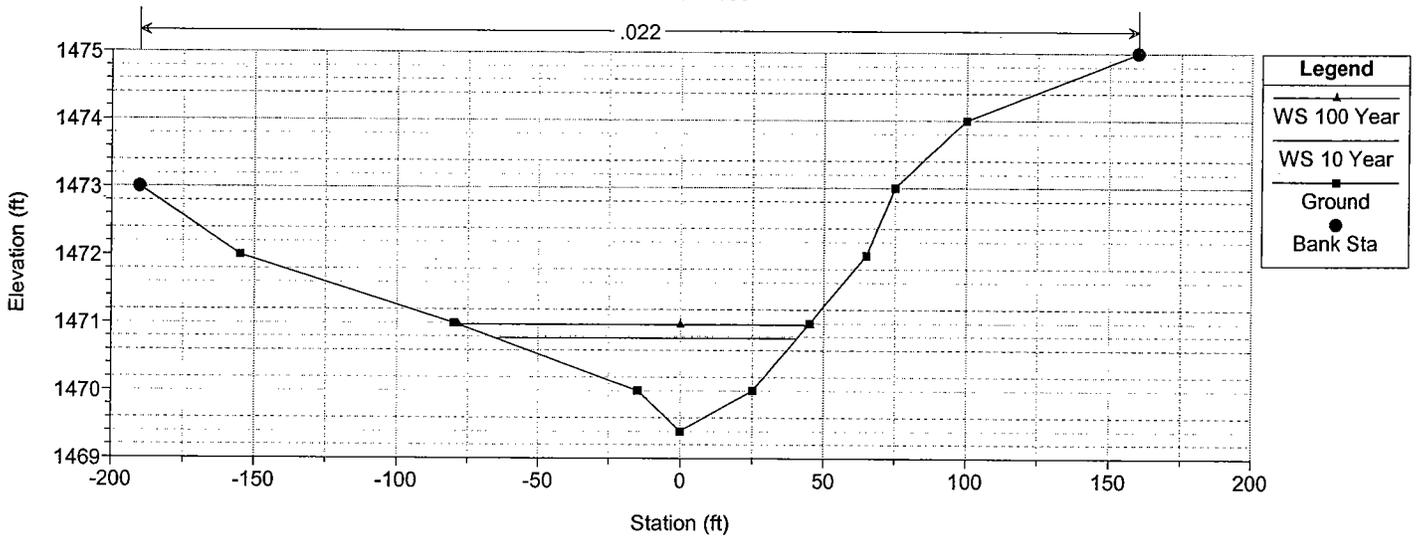
RS = 200



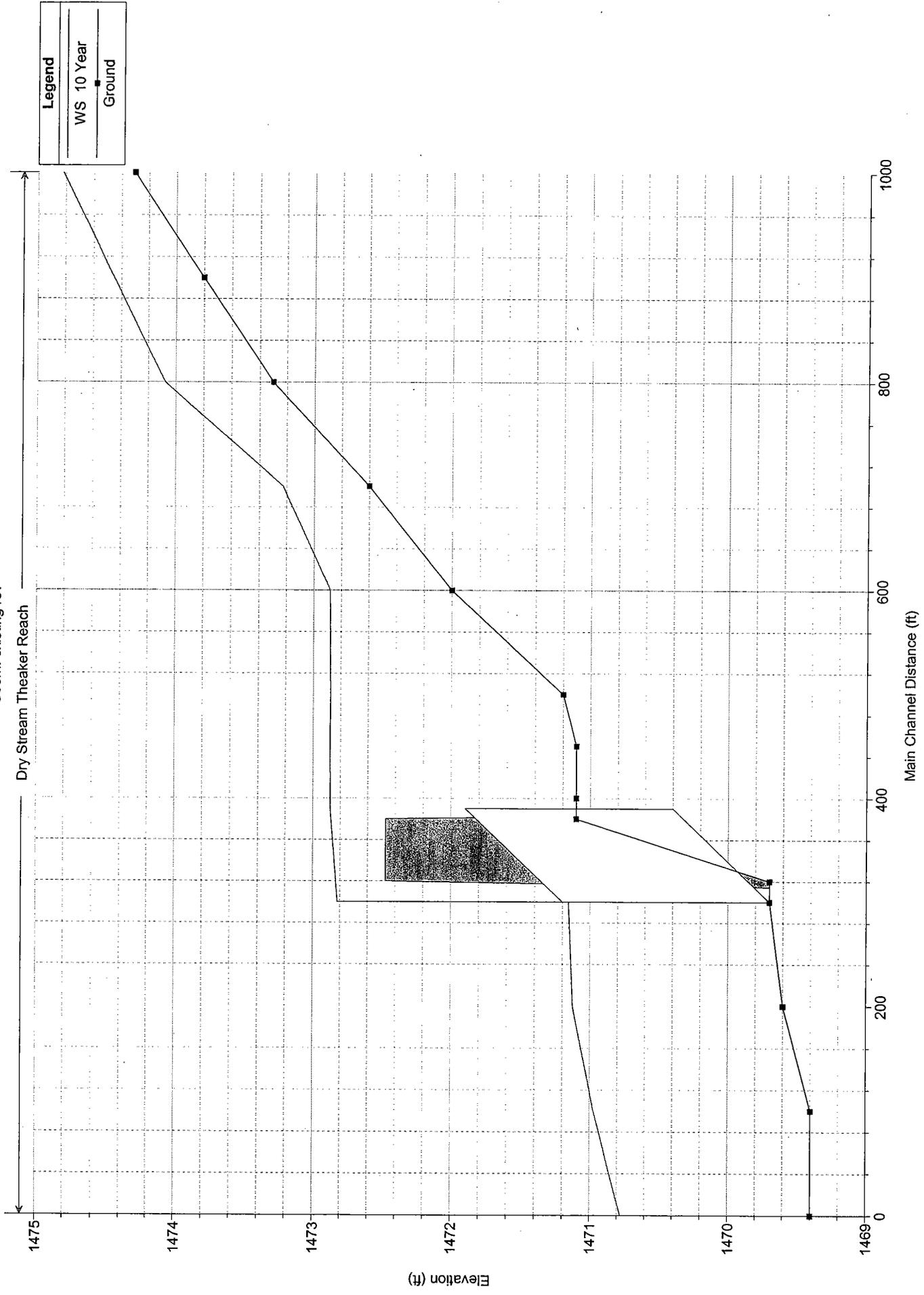
Theaker Property

Geom: existing rev

RS = 100



Theaker Property
Geom: existing rev



Legend	
—	WS 10 Year
—	Ground

HEC-RAS Plan: Plan 06 River: Dry Stream Reach: Theaker Reach

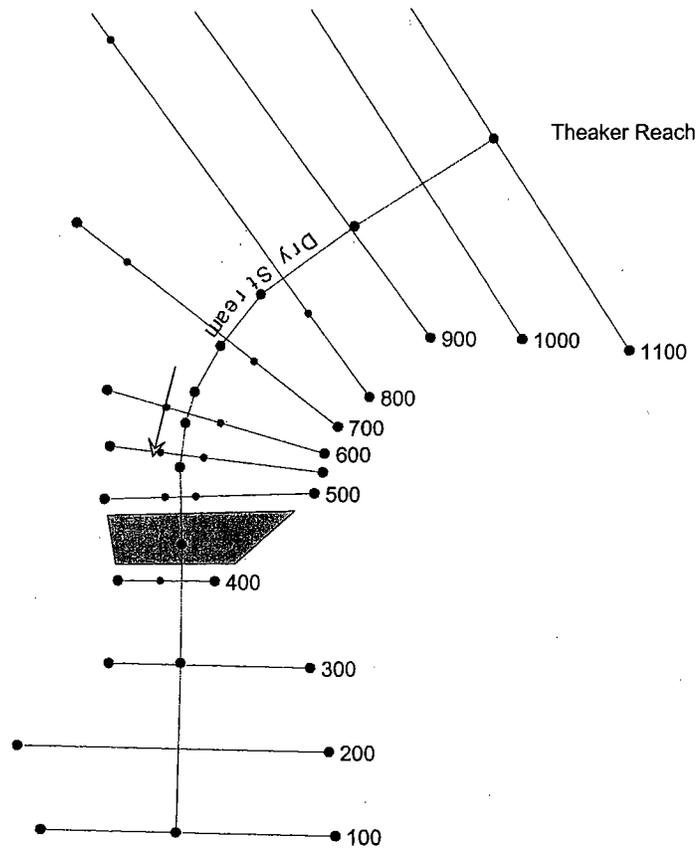
Reach	River Star	Profile	Q Total (cfs)	Min Ch El (ft)	WS Elev (ft)	Ch W/S (ft)	E-G Elev (ft)	E-G Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Flouder #	Chl
Theaker Reach	1100	10 Year	136.00	1474.30	1474.82	1474.75	1474.88	0.005612	2.06	66.14	255.35		0.71
Theaker Reach	1100	100 Year	197.00	1474.30	1474.90	1474.82	1474.98	0.005495	2.24	88.03	294.58		0.72
Theaker Reach	1000	10 Year	136.00	1473.80	1474.45		1474.49	0.002828	1.58	86.27	296.68		0.52
Theaker Reach	1000	100 Year	197.00	1473.80	1474.52		1474.57	0.003075	1.81	108.64	322.47		0.55
Theaker Reach	900	10 Year	136.00	1473.30	1474.08	1474.01	1474.12	0.004958	1.66	82.14	399.85		0.64
Theaker Reach	900	100 Year	197.00	1473.30	1474.13	1474.07	1474.19	0.004773	1.88	104.90	410.80		0.65
Theaker Reach	800	10 Year	136.00	1472.60	1473.23	1473.23	1473.38	0.011555	3.11	43.67	155.43		1.04
Theaker Reach	800	100 Year	197.00	1472.60	1473.33	1473.33	1473.49	0.010357	3.24	60.71	187.17		1.00
Theaker Reach	700	10 Year	136.00	1472.00	1472.88	1472.46	1472.90	0.000444	0.94	144.59	269.24		0.23
Theaker Reach	700	100 Year	197.00	1472.00	1472.99	1472.53	1473.01	0.000546	1.13	174.61	288.92		0.26
Theaker Reach	600	10 Year	136.00	1471.20	1472.88		1472.88	0.000060	0.49	276.03	301.54		0.09
Theaker Reach	600	100 Year	197.00	1471.20	1472.98		1472.99	0.000093	0.64	308.23	316.95		0.11
Theaker Reach	550	10 Year	136.00	1471.10	1472.88		1472.88	0.000014	0.32	429.58	303.03		0.05
Theaker Reach	550	100 Year	197.00	1471.10	1472.98		1472.98	0.000023	0.43	461.52	309.70		0.06
Theaker Reach	500	10 Year	136.00	1471.10	1472.88	1471.35	1472.88	0.000013	0.29	465.87	352.13		0.04
Theaker Reach	500	100 Year	197.00	1471.10	1472.98	1471.42	1472.98	0.000022	0.39	503.05	363.66		0.06
Theaker Reach	450		Culvert										
Theaker Reach	400	10 Year	155.00	1469.70	1471.16		1471.36	0.002672	3.64	42.63	39.87		0.62
Theaker Reach	400	100 Year	227.00	1469.70	1471.31		1471.65	0.003832	4.63	49.01	41.75		0.75
Theaker Reach	300	10 Year	155.00	1469.60	1471.12		1471.17	0.000907	1.70	91.33	119.79		0.34
Theaker Reach	300	100 Year	227.00	1469.60	1471.34		1471.39	0.000951	1.92	118.07	133.11		0.36
Theaker Reach	200	10 Year	155.00	1469.40	1470.97		1471.04	0.001752	2.16	71.79	107.49		0.47
Theaker Reach	200	100 Year	227.00	1469.40	1471.18		1471.26	0.001794	2.37	95.66	126.59		0.48
Theaker Reach	100	10 Year	155.00	1469.40	1470.78	1470.45	1470.86	0.002001	2.26	68.57	105.91		0.50
Theaker Reach	100	100 Year	227.00	1469.40	1470.98	1470.61	1471.07	0.002001	2.48	91.50	122.95		0.51

Appendix C
Proposed
Conditions

HEC-RAS
FLOOD PLAN STUDY

PROPOSED CONDITIONS

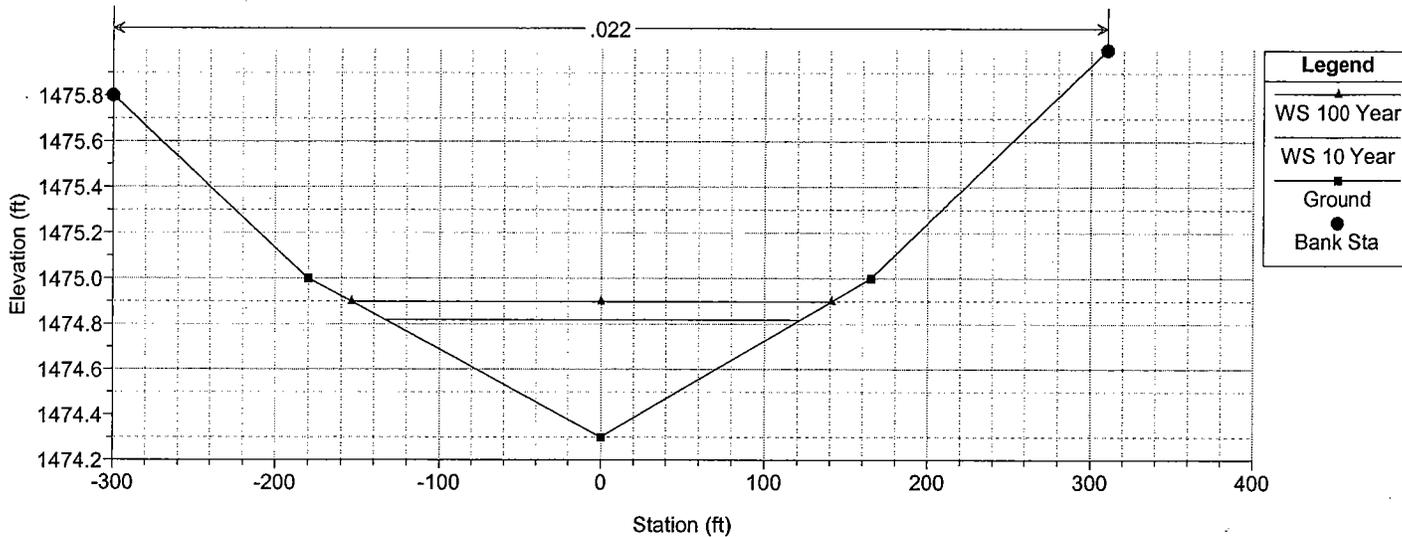
PROPOSED CONDITIONS



Theaker Property

Geom: proposed

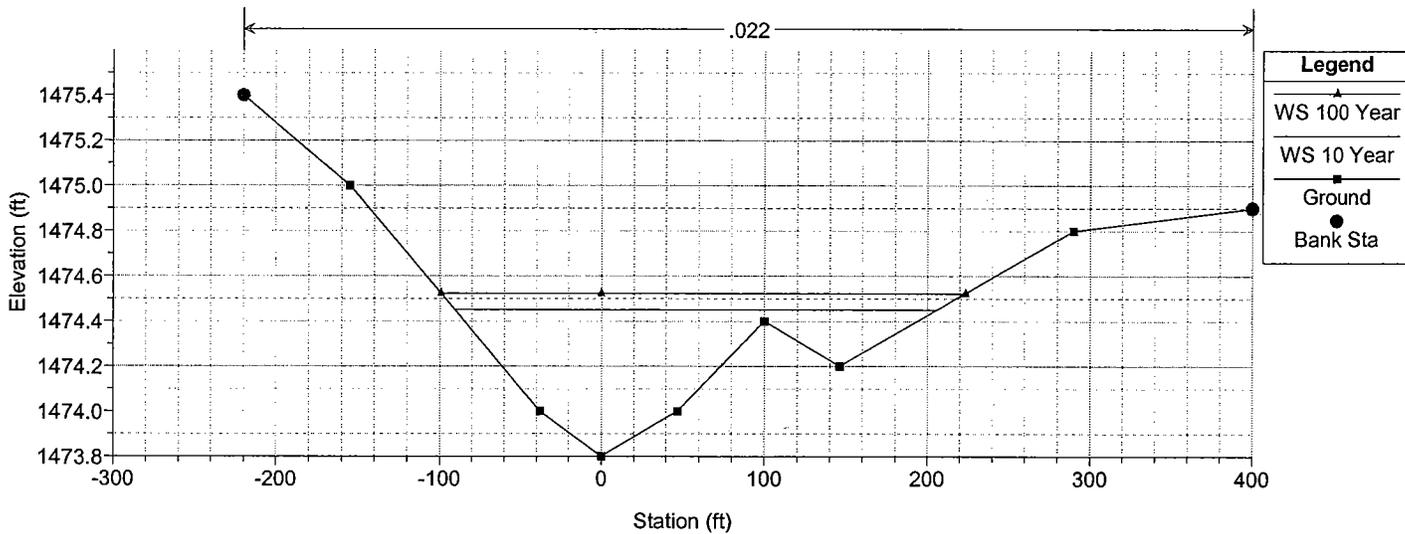
RS = 1100



Theaker Property

Geom: proposed

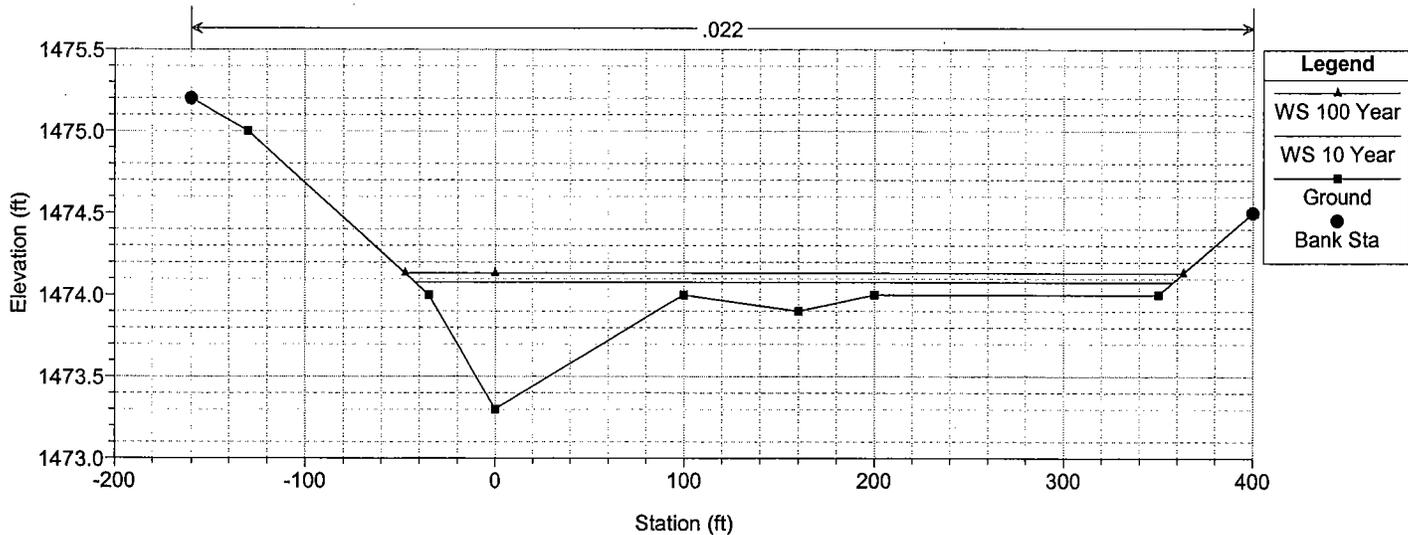
RS = 1000



Theaker Property

Geom: proposed

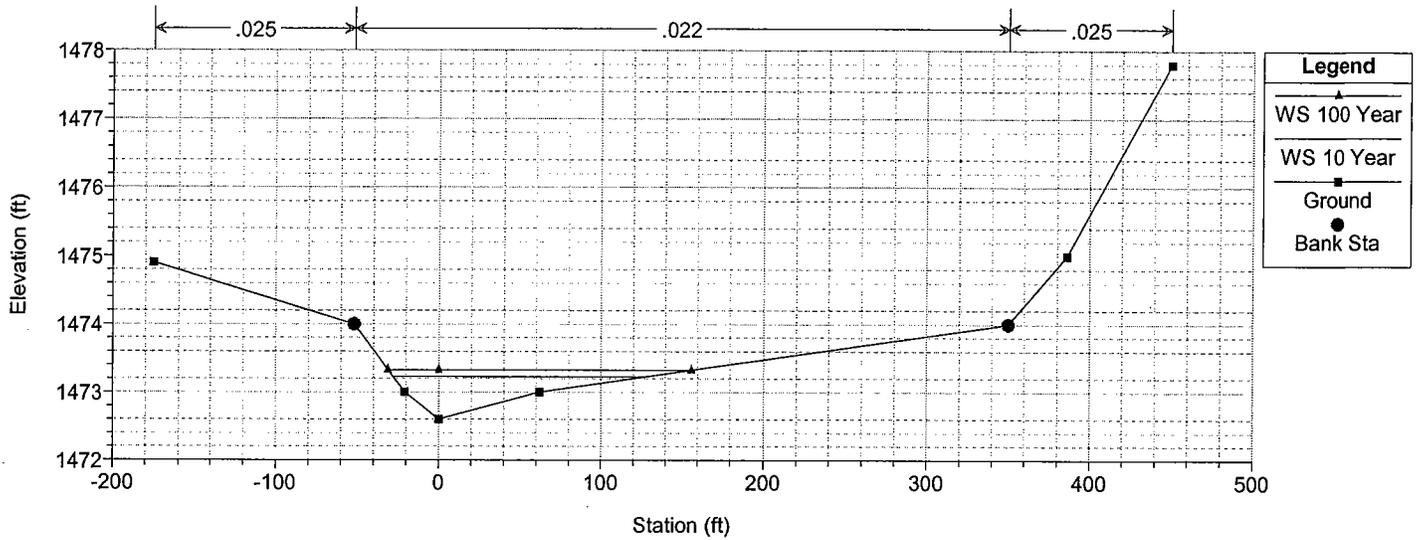
RS = 900



Theaker Property

Geom: proposed

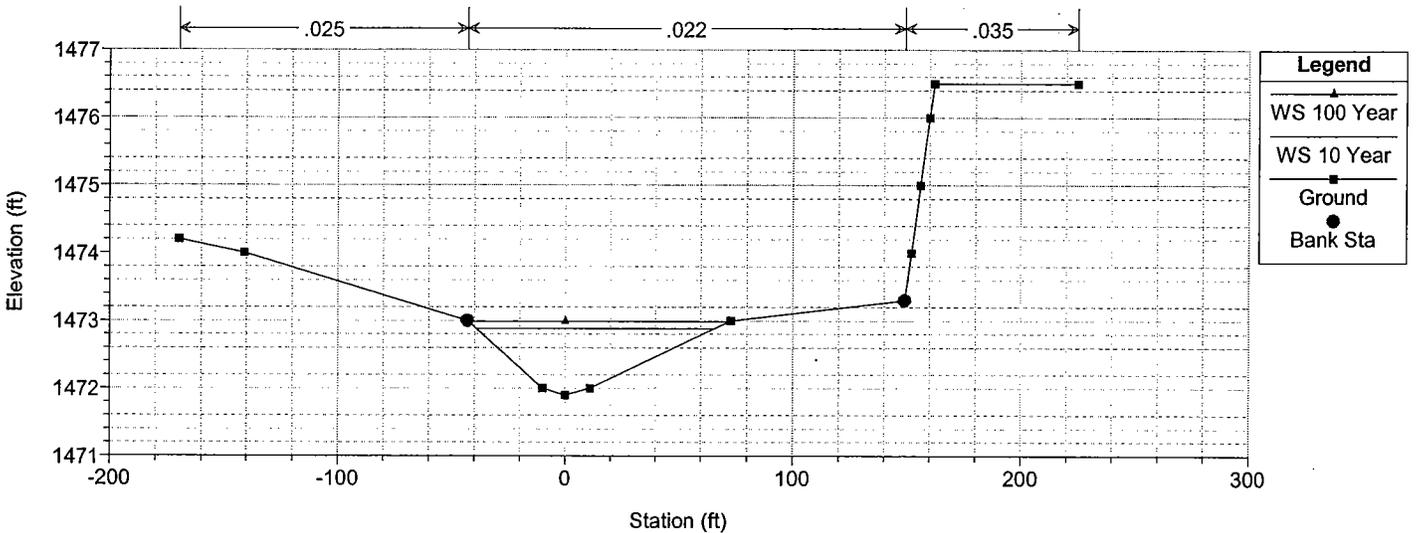
RS = 800



Theaker Property

Geom: proposed

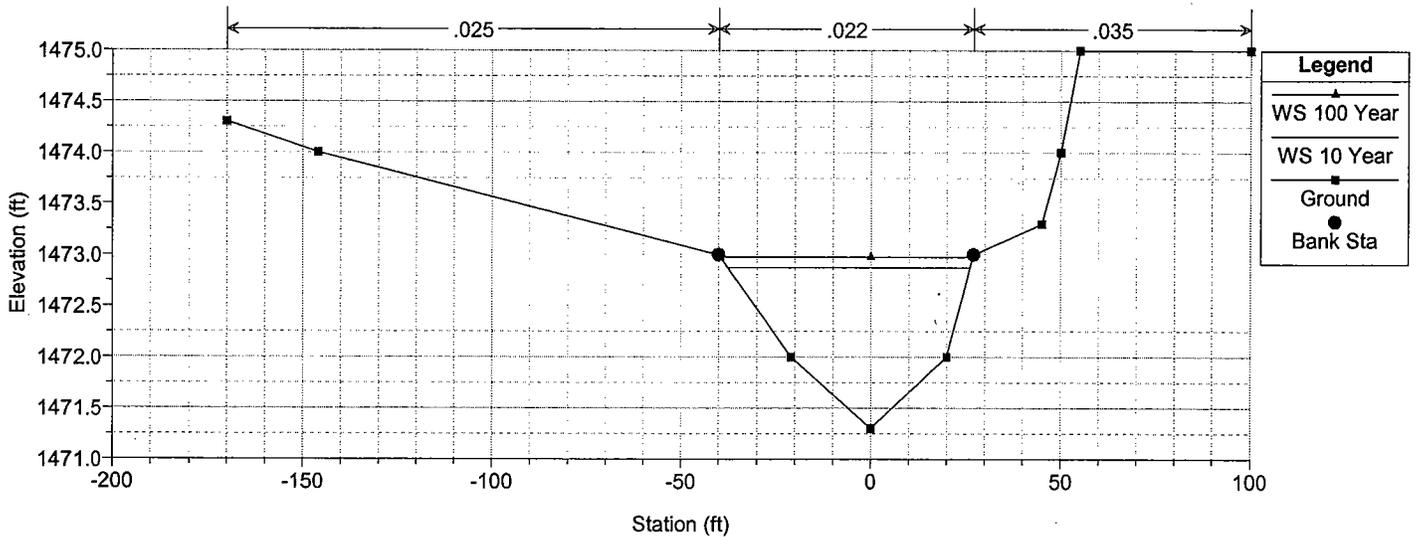
RS = 700



Theaker Property

Geom: proposed

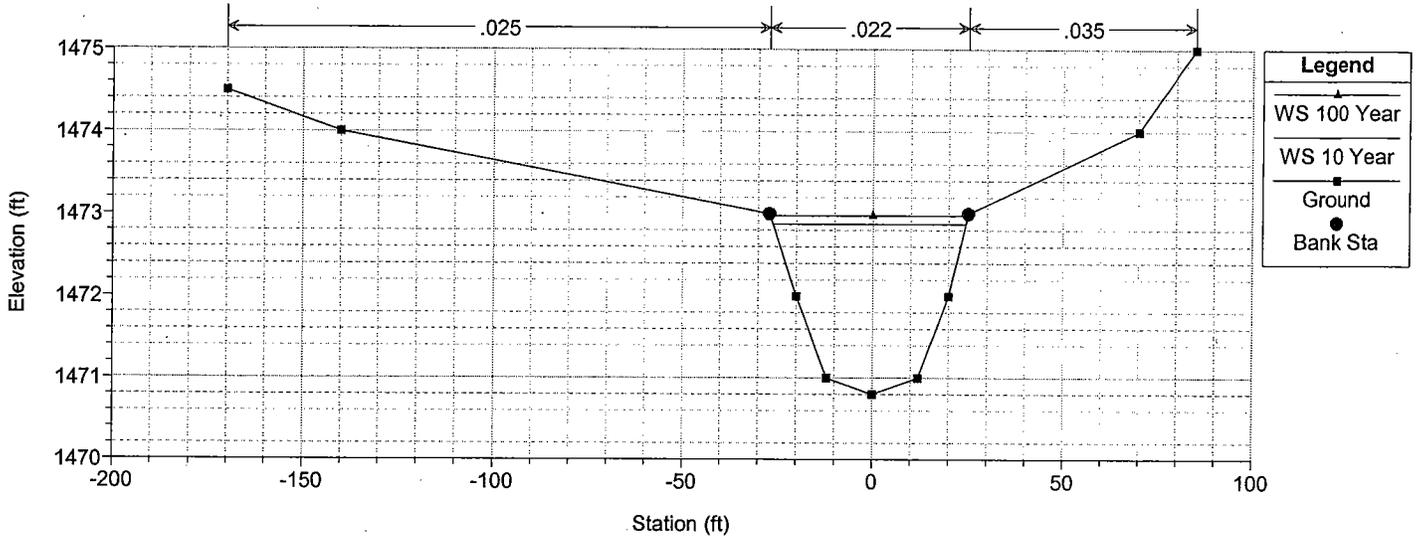
RS = 600



Theaker Property

Geom: proposed

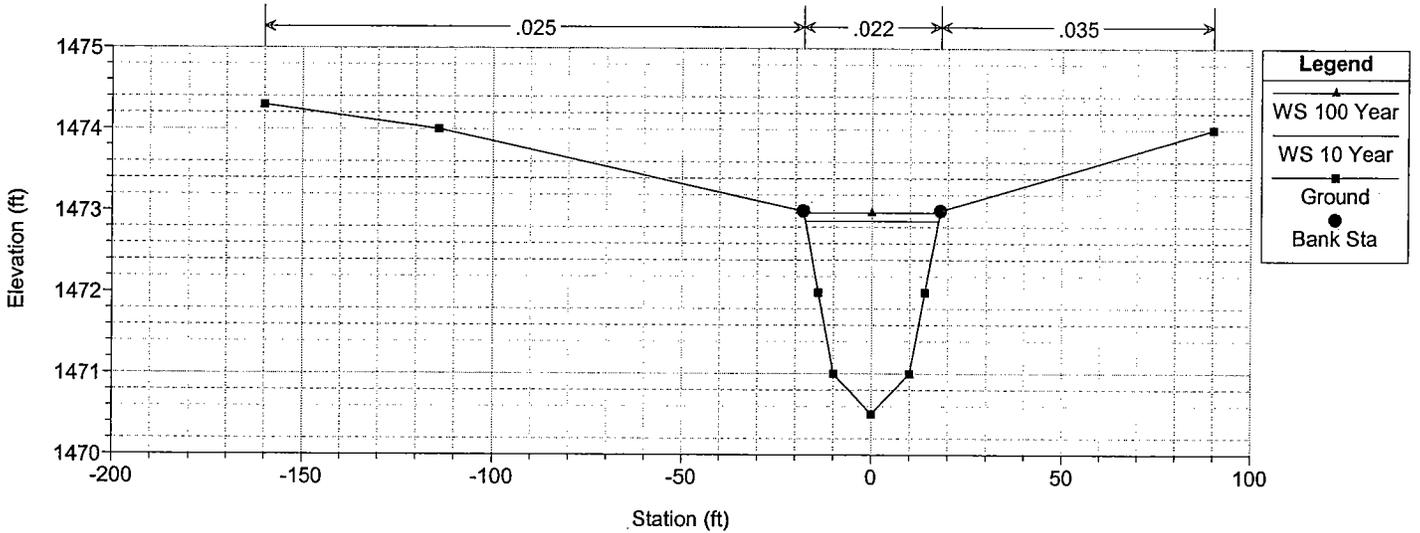
RS = 550



Theaker Property

Geom: proposed

RS = 500

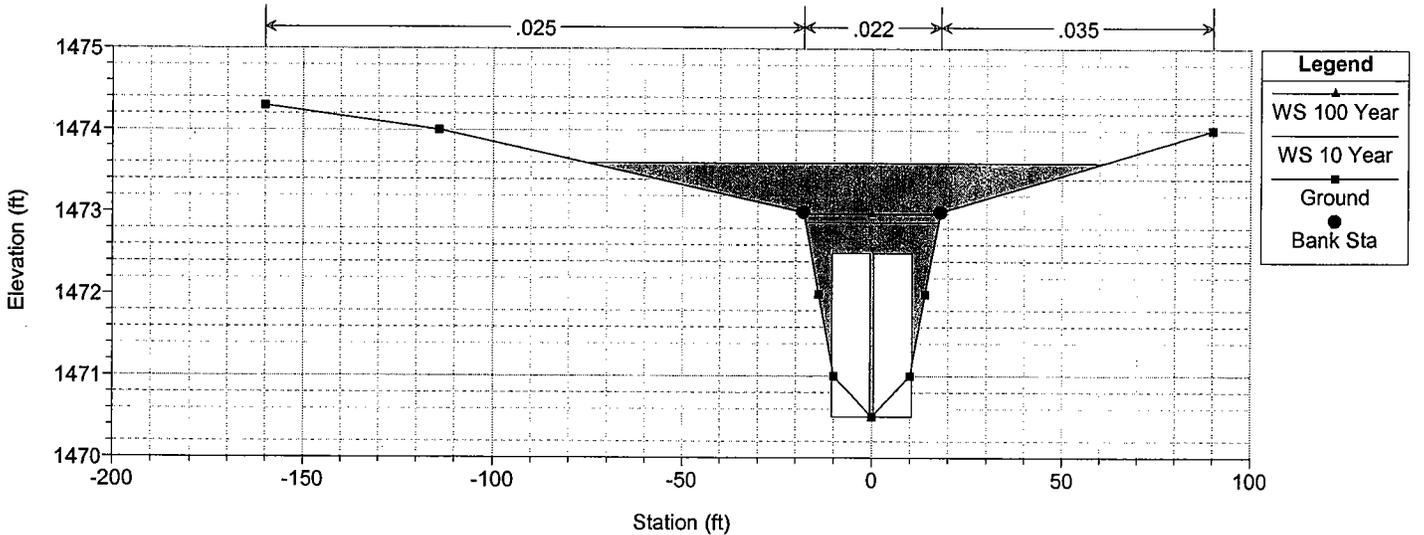


Theaker Property

Geom: proposed

RS = 450

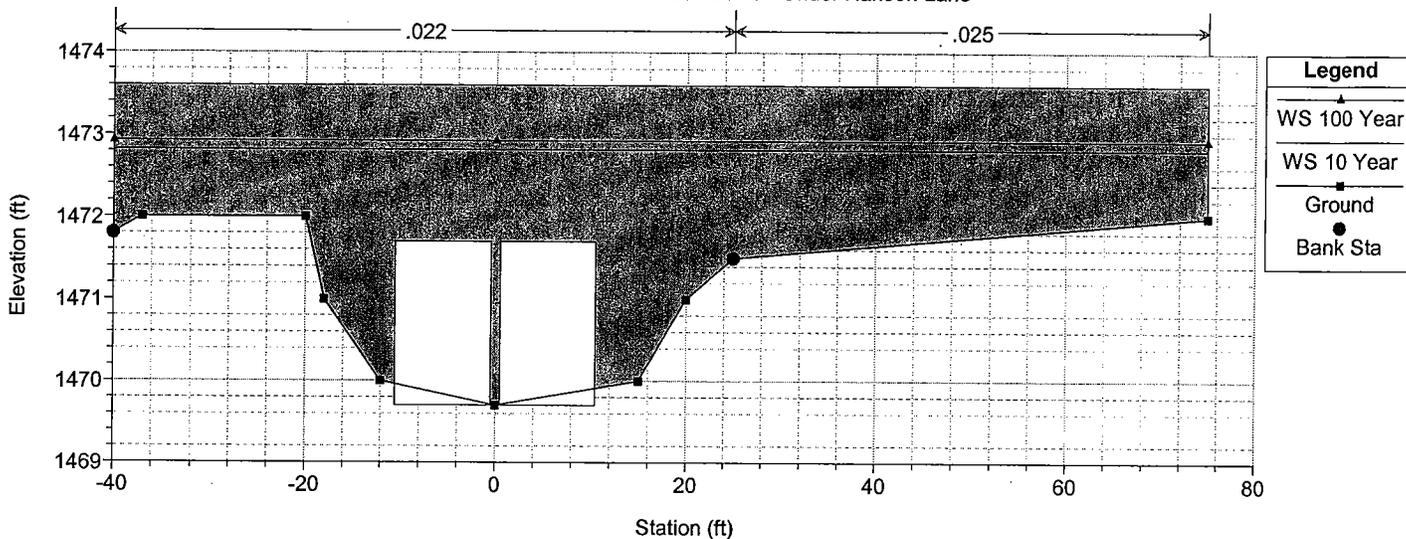
Culv Box Culvert Under Hanson Lane



Theaker Property

Geom: proposed

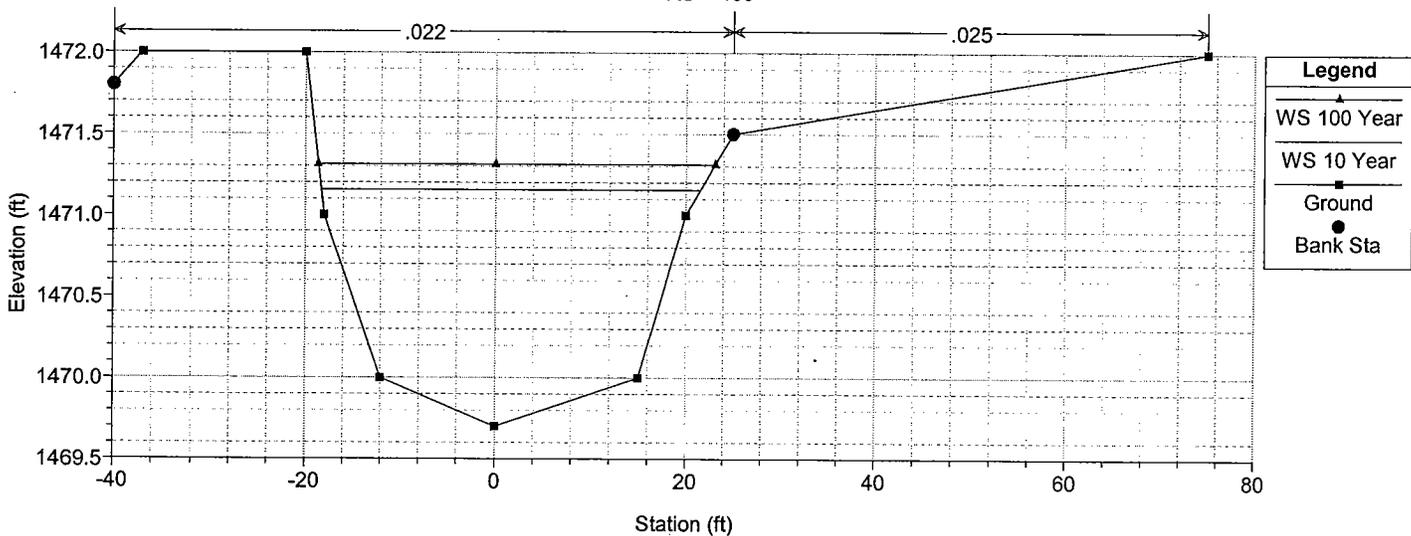
RS = 450 Culv Box Culvert Under Hanson Lane



Theaker Property

Geom: proposed

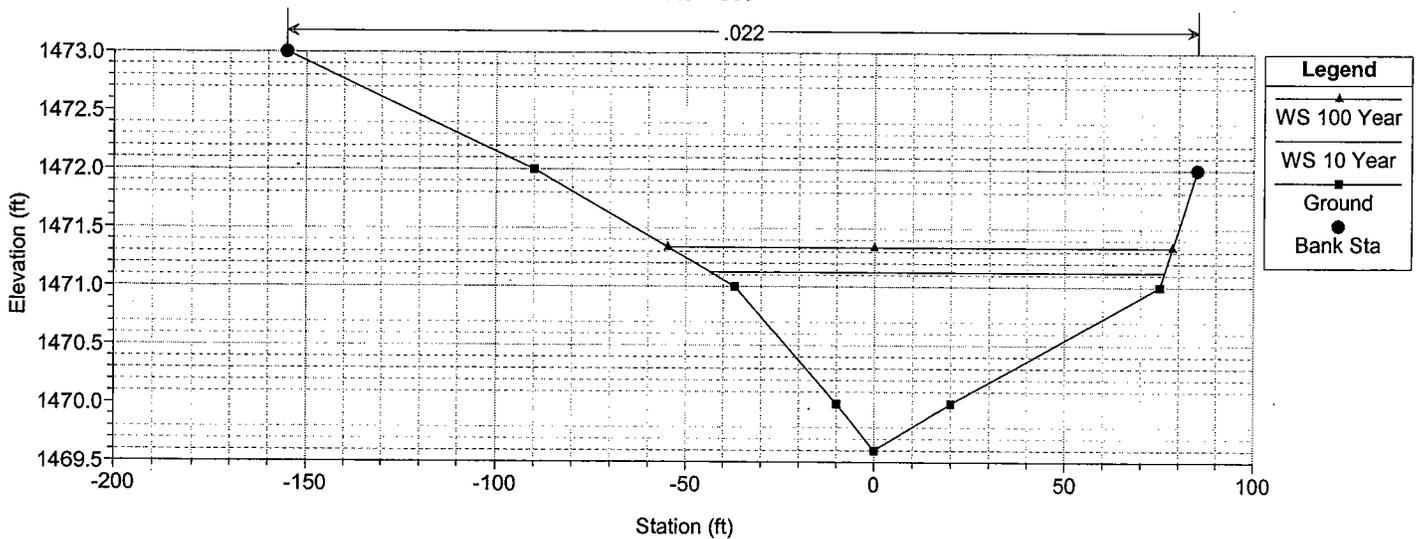
RS = 400



Theaker Property

Geom: proposed

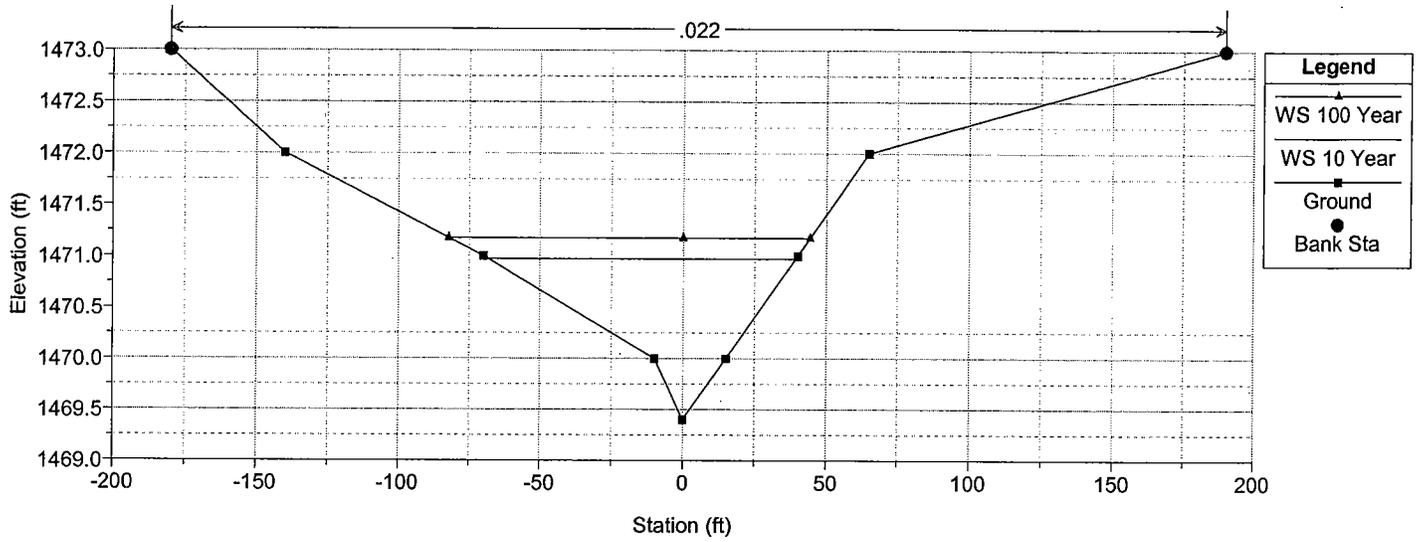
RS = 300



Theaker Property

Geom: proposed

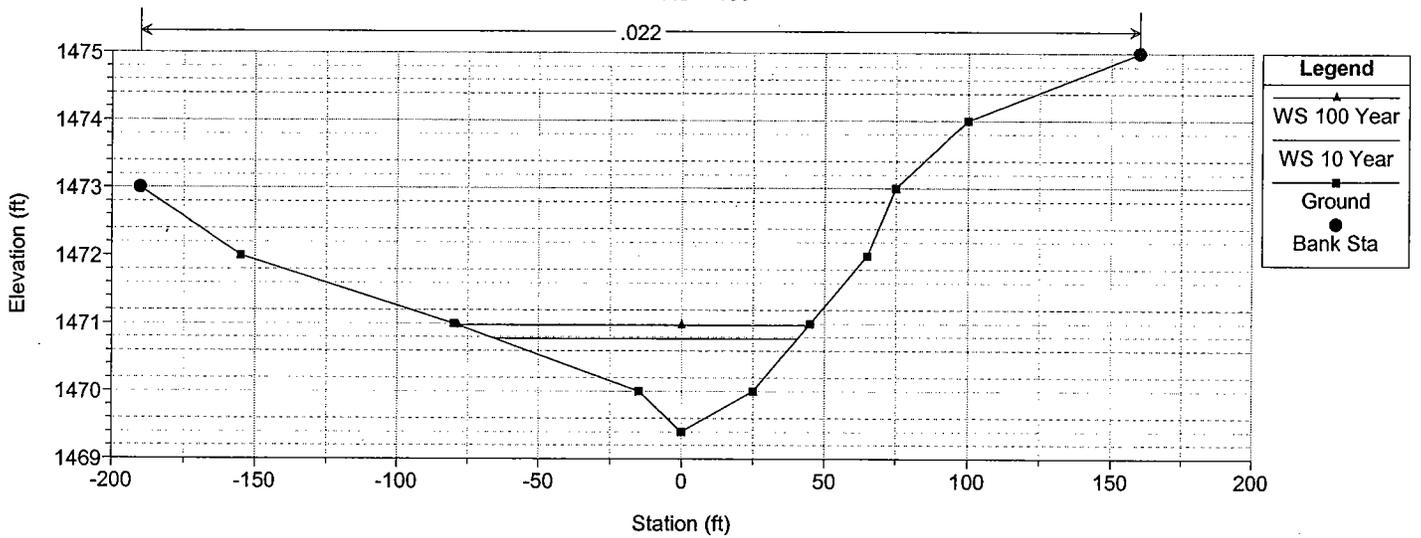
RS = 200



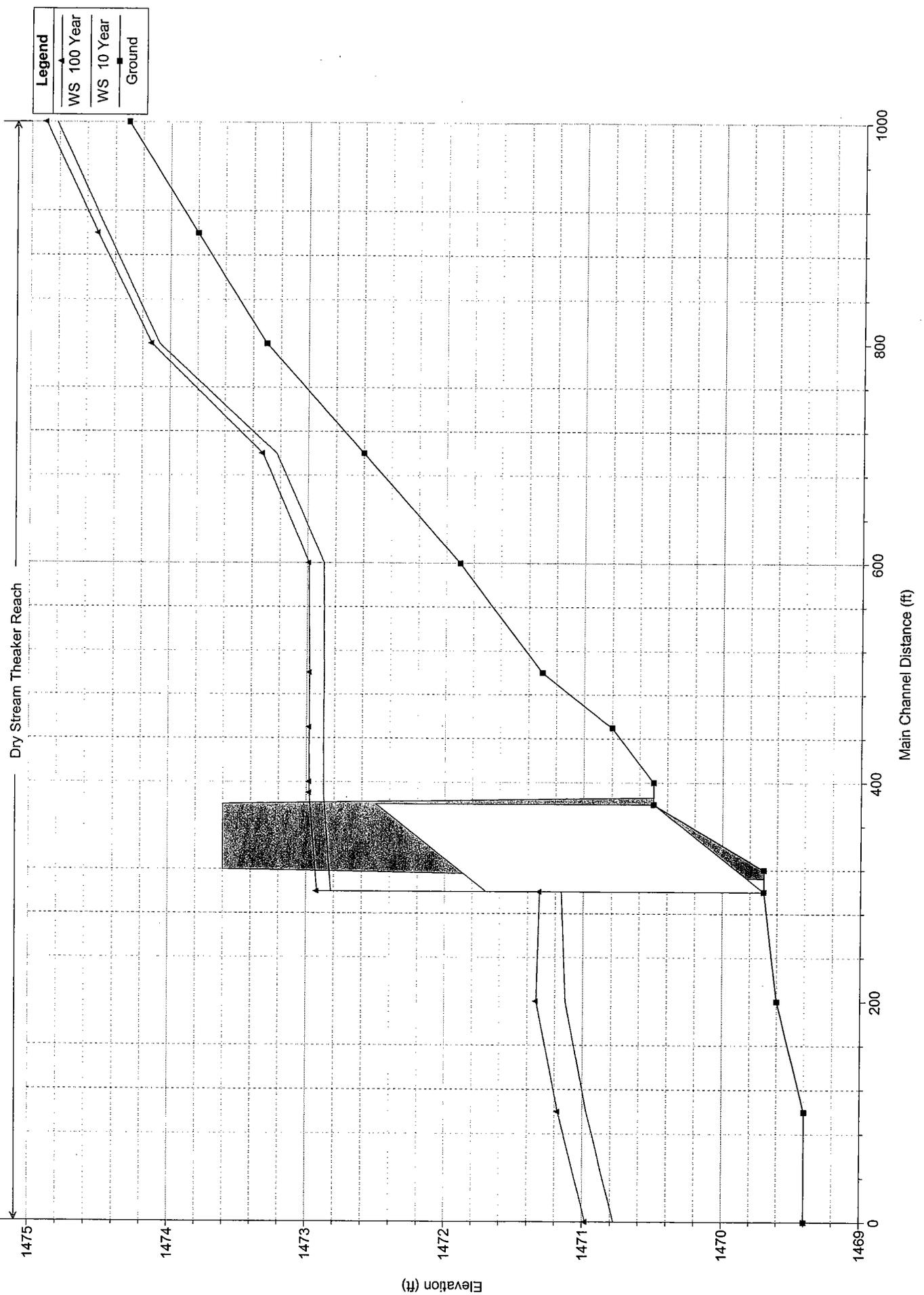
Theaker Property

Geom: proposed

RS = 100



Theaker Property
Geom: proposed



HEC-RAS Plan: Plan 06 River: Dry Stream Reach: Theaker Reach

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W/S Elev (ft)	Ont WS (ft)	EG Elev (ft)	EG Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Floude # Chl
Theaker Reach	1100	10 Year	136.00	1474.30	1474.82	1474.75	1474.88	0.005612	2.06	66.14	255.35	0.71
Theaker Reach	1100	100 Year	197.00	1474.30	1474.90	1474.82	1474.98	0.005495	2.24	88.03	294.58	0.72
Theaker Reach	1000	10 Year	136.00	1473.80	1474.45		1474.49	0.002828	1.58	86.27	296.68	0.52
Theaker Reach	1000	100 Year	197.00	1473.80	1474.52		1474.57	0.003075	1.81	108.64	322.47	0.55
Theaker Reach	900	10 Year	136.00	1473.30	1474.08	1474.01	1474.12	0.004958	1.66	82.14	399.85	0.64
Theaker Reach	900	100 Year	197.00	1473.30	1474.13	1474.07	1474.19	0.004773	1.88	104.90	410.80	0.65
Theaker Reach	800	10 Year	136.00	1472.60	1473.23	1473.23	1473.38	0.011555	3.11	43.67	155.43	1.04
Theaker Reach	800	100 Year	197.00	1472.60	1473.33	1473.33	1473.49	0.010357	3.24	60.71	187.17	1.00
Theaker Reach	700	10 Year	136.00	1472.00	1472.88	1472.46	1472.90	0.000444	0.94	144.59	269.24	0.23
Theaker Reach	700	100 Year	197.00	1472.00	1472.99	1472.53	1473.01	0.000546	1.13	174.61	288.92	0.26
Theaker Reach	600	10 Year	136.00	1471.20	1472.88		1472.88	0.000060	0.49	276.03	301.54	0.09
Theaker Reach	600	100 Year	197.00	1471.20	1472.98		1472.99	0.000093	0.64	308.23	316.95	0.11
Theaker Reach	550	10 Year	136.00	1471.10	1472.88		1472.88	0.000014	0.32	429.58	303.03	0.05
Theaker Reach	550	100 Year	197.00	1471.10	1472.98		1472.98	0.000023	0.43	461.52	309.70	0.06
Theaker Reach	500	10 Year	136.00	1471.10	1472.88	1471.35	1472.88	0.000013	0.29	465.87	352.13	0.04
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Theaker Reach	300	100 Year	227.00	1469.60	1471.34		1471.39	0.000951	1.92	118.07	133.11	0.36
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Theaker Reach	100	100 Year	227.00	1469.40	1470.98	1470.61	1471.07	0.002001	2.48	91.50	122.95	0.51